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VISUAL ABSORPTION IN SELECTED VEGETATION TYPES OF THE LAKE TAHOE BASIN

T. H. Mikkelsen

Summary Report, Coop. Agree. Supp. #106

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REPORT
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VISUAL ABSORPTION IN SELECTED VEGETATION TYPES OF THE LAKE TAHOE BASIN

SUMMARY REPORT - A WORKING OUTLINE

Cooperative Agreement Supplement #106,
Department of Landscape Architecture,
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reported by

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PREFACE

This report is a summary of the research conducted as of this date concerning the relative capacity of selected vegetation types in the Lake Tahoe basin to visually absorb manmade objects. The report consists of four major sections and three appendices. Each section in turn consists of a lead in paragraph(s) which will explain, qualify, or summarize the section and, in outline form the remaining content of the section. This format is intended to provide the basic organizational framework for a subsequent final report on this subject.

INTRODUCTION

The forests of the Lake Tahoe basin are one of the most endearing natural resources of the region. Mature, dense stands of pine and fir greet the visitor upon entering the basin and lead him to the shores of Lake Tahoe. Virtually all of the land in the basin, with the exception of the high granite peaks and grassland meadows, is forested. This vegetation performs the ecological functions of erosion control, climatic modification, and the provision of habitat for the region's numerous fauna while at the same time providing an important part of the lake's scenic landscape.

PURPOSE OF THE STUDY

Vegetation also provides a foil or screen, depending on specific forest conditions, which affects human vision by screening or absorbing objects within it. This capability of vegetation to absorb objects, or "screen them from view" is the topic of research summarized in this paper. The research was authorized in May of 1971 by a letter from then Assistant Director H. W. Camp. Specifically this study would concentrate on:

(1) Bibliographic review, identification of outdoor elements and conditions relating to visual acuity and obscurity (i.e., fire protection and observation studies).

(2) Develop field observation techniques: using either existing structures within various forest types (with differing stand conditions) or by using targets develop a standardized means of making visibility comparisons. Lake Tahoe is to be used as the test area.

(3) Identify critical factors, suggest predictability of impacts: using field observation tests, summarize conditions and factors that influence how sensitive or resistant different forest types and stands are to the visual impacts of development, what predictions may be made concerning the capacity of various forest types to visually "absorb" structures or buildings, etc. This should lead to identification of conditions that are sensitive or resistant in maintaining the general integrity or continuity of the landscape as a visual environment.

PHASES OF STUDY

1. Report by David Hansen, February 1973, Visual Absorption, Lake Tahoe Basin 1971, 1972

   a. Bibliographic review (see Appendix A, page 17)

   b. Study design

      Assumptions: a portable target for use in any forest condition would be used to surrogate manmade conditions, judgments as to when the target was "absorbed" would be made by eye and distances measured by foot pacing, recorded on field notation sheets which were in turn keyed to photographs in both color and black and white.

   c. Field work

      Data gathered at 22 points for various forest types and conditions

   d. Data synthesis and analysis charts, graphs, and photographs (see Appendix B, page 20)

e. Conclusions

Factors affecting absorption, insufficient data for conclusions to be drawn concerning absorption, surrogate target does not adequately represent manmade conditions.

2. Field Work, June 1973

a. Field work

Data collected at 20 additional photo points, sampling process simplified, additional forest types studied.

3. Analysis and Conclusions (the balance of this report)

a. Integration of field studies

Assumptions concerning data, development of a consistent data base

b. Analysis and summation of data

Study variables, comparative charts on sun angle, vegetation type and density, and horizontal distances at which the target is absorbed (obscured)

c. Findings and Conclusions

Significant factors affecting absorption, absorptive capabilities of selected forest types, further studies

PRELIMINARY FINDINGS

The findings presented here concern two primary aspects of visual absorption, namely, (1) the significant factors which affect absorption, and (2) the measured absorption capacities for three forest types. Here, capacity is meant to refer to the horizontal distance at which the portable target is obscured from view. The maximum horizontal distances measured are well within the foreground distance zone[1] which indicates that site specific problem solving is the scale at which this information is applicable. The findings are preliminary and subject to modification and further qualifications as data becomes available.

SIGNIFICANT FACTORS AFFECTING ABSORPTION

1. Vegetation
    a. Stand density
    b. Stand maturity or age/condition
    c. Understory type (deciduous, evergreen, shrubby, successional regeneration)
    d. Understory density
2. Topography
    a. Enclosure (figure ground relationship)
    b. Exposure (silhouette and figure ground relationship)
3. Character of manmade object
    a. Relative extent and specific configuration of mass, color, texture and tone

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[1] Forest Landscape Descriptions and Inventories - A Basis for Land Planning and Design. R. B. Litton, Jr., 1968, p. 3.

ABSORPTION CAPACITIES FOR 3 FOREST TYPES TRPA CLASSIFICATIONS (BY DENSITY)

(Horizontal distances at which target is obscured)

1. Pine
    a. Open 600'
    b. Moderate 305'
    c. Dense 225'
2. Mixed Conifer
    a. Open 385'
    b. Moderate 337'
    c. Dense 213'
3. Fir
    a. Open ---
    b. Moderate 250'
    c. Dense 215'

DATA ANALYSIS

In order to integrate the base data gathered by researchers during the first two phases of study (for analysis by a third researcher) it was necessary to make several assumptions concerning this data. The first was that the number of study variables noted by researchers were too complex and lacking in specific detail (e.g., topography) for adequate analysis and too numerous in comparison to the relatively small (42) number of samples. The seemingly most important variables of vegetation type, vegetation density, sun angle and direction would be studied for their effect upon visual absorption. It then became apparent (Figure 4 and Appendix B) that sun angle and direction had very little effect on absorption except in the case of extremes such as sunrise or sunset and front lit versus back lit targets. Another major assumption was that since aspects of the field sampling techniques were changed in the two phases of study only the maximum distances at which the target disappeared would be used. Oblique samples and intermediate distance samples would be dropped out.

A consistent data base was then prepared for analysis by (1) grouping the numerous vegetation types sampled into the broad vegetation classification used by the Tahoe Regional Planning Agency[2], and (2) preparing a photographic record for all points in order to establish a relative measure of vegetation density, since the TRPA classification was general

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[2] Vegetation of the Lake Tahoe Basin. Rice, R., et al, TRPA, USDA Forest Service, 1971.

and not accurate in detail for specific points, and to eliminate errors and poor samples. It is of the utmost importance to say that the visual comparison of standardized photographic enlargements (3X) was used to designate open, medium, and dense stand density categories. From this record 32 points were selected for analysis (Appendix C). With Appendix C there are some detailed observations concerning various interpretations of visual absorption, screening and other relationships which produce observation[1] or apparency.[1] It was noted that the red/green side of the target disappeared sooner than the white/yellow side, therefore the maximum distances given are for the white/yellow side only.

INTEGRATION OF FIELD STUDIES

1. Assumptions Concerning Data
    a. Simplify study variables
2. Develop a Consistent Data Base
    a. Data groupings
        Sun angle, forest types using TRPA classification, relative density
        TRPA vegetation types sampled
            Herbaceous
            Broadleaf
            Pine
            Mixed conifer
            Fir
            Lodgepole pine

[1] In this study, meaning observation of the target and conditions affecting the degree of its apparency.

Not sampled

Bare ground

Sagebrush

Montana chaparral

Alpine

b. Photographic record

To provide a comparison of relative forest conditions and to eliminate bad samples

FACTORS AFFECTING ABSORPTION

1. Study Variables

a. Vegetation

Age, type, density, understory type and density, successional stage

b. Lighting

Angle, intensity, direction, season, climate

c. Topography

Enclosure, exposure, steepness, observer position

d. Human visual acuity, awareness, judgment errors

2. Comparative Charts

a. Sun angle (figures 1 and 2)

Plot of the principal direction of photo points and the sun angle (elevation) at the time of the photograph

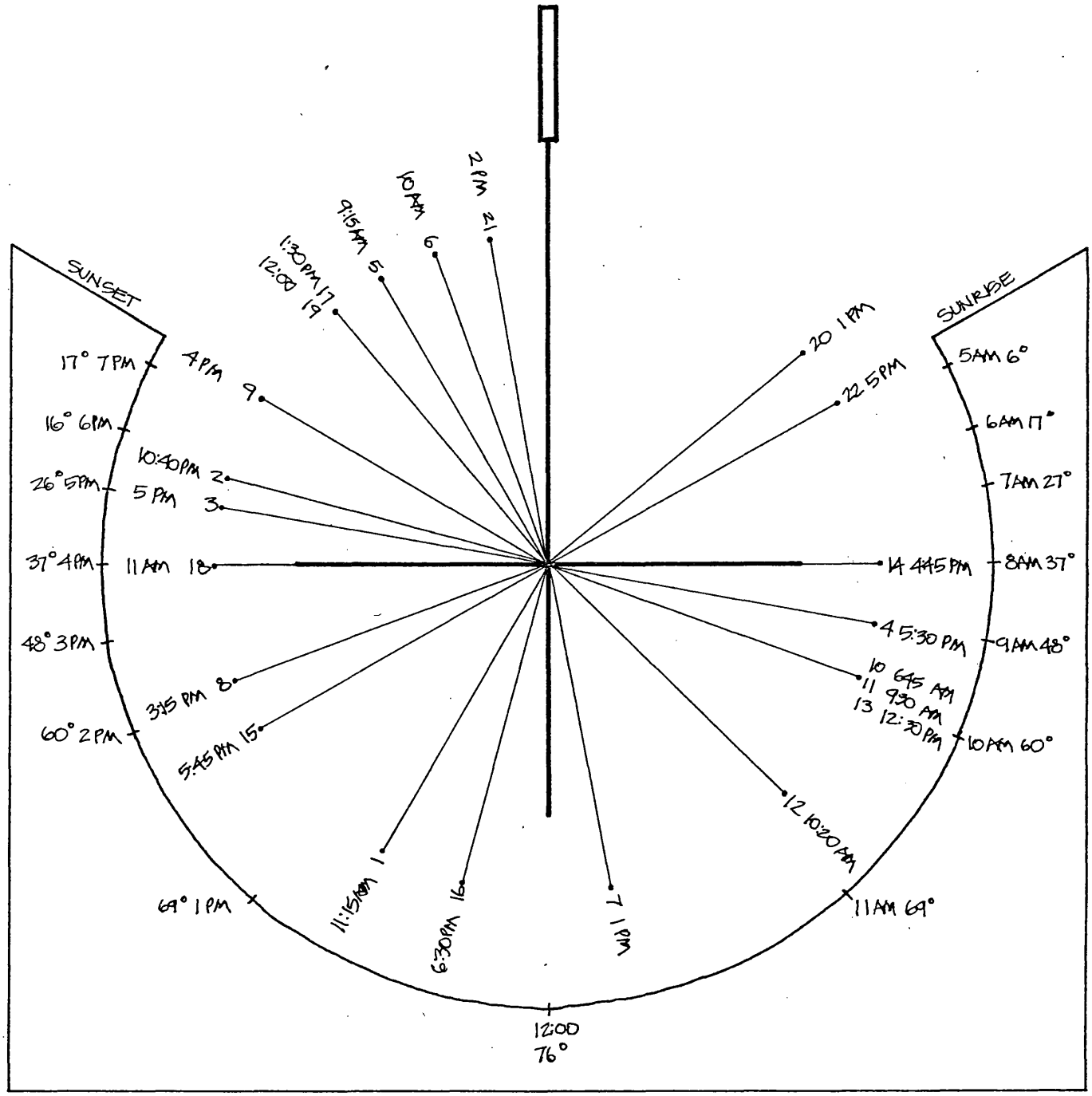

Figure 1
Sun Angle
LAKE TAHOE VISUAL ABSORPTION STUDY

PHOTO POINTS 1-22
OUTER CIRCLE - SUN TIME & ANGLE
INNER CIRCLE - PHOTO TIME & DIRECTION

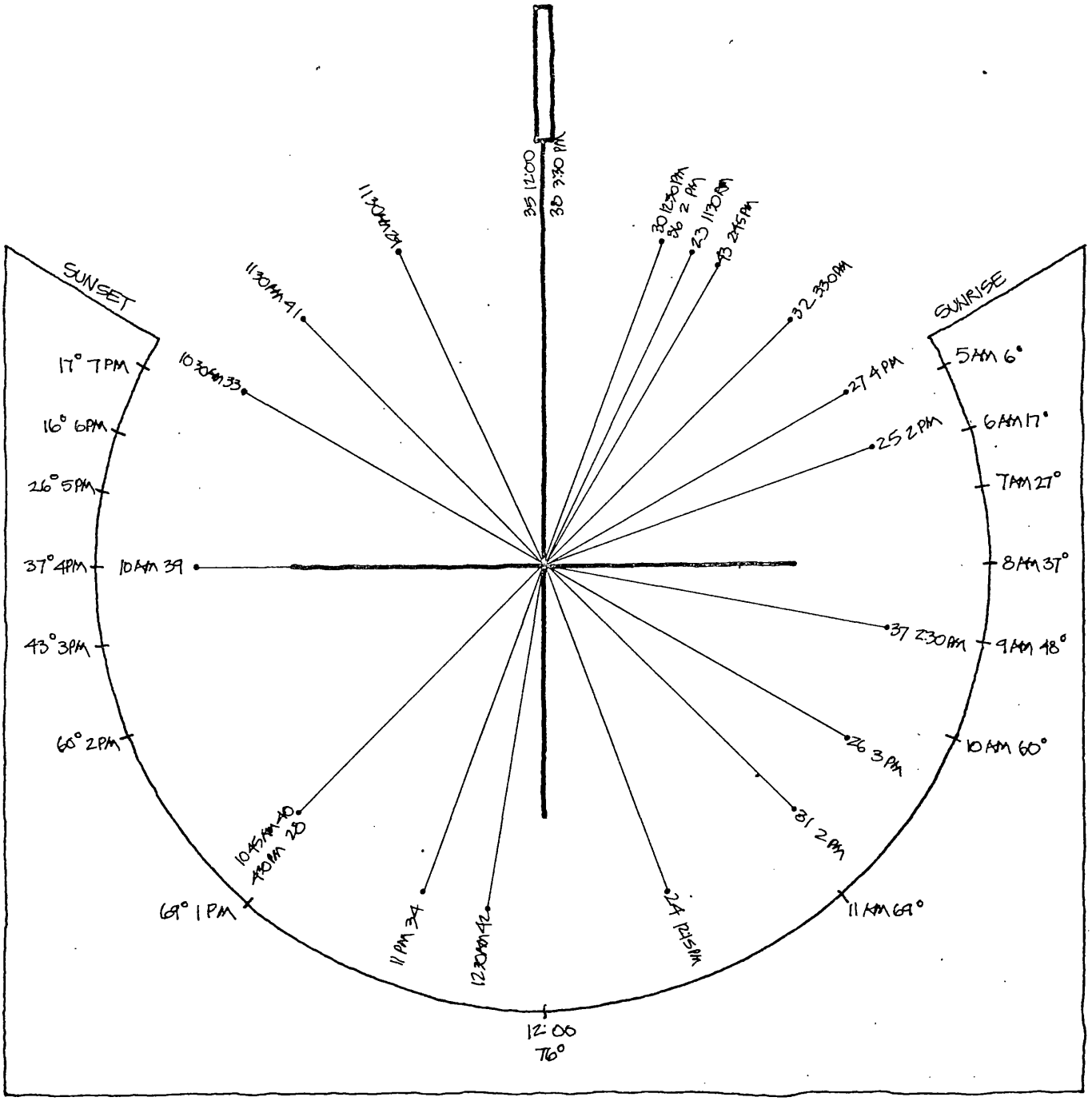

Figure 2
Sun Angle
LAKE TAHOE VISUAL ABSORPTION STUDY

PHOTO POINTS 23-43
OUTER CIRCLE - SUN TIME & ANGLE
INNER CIRCLE - PHOTO TIME & DIRECTION

b. Summary (Figure 3)

Chart of vegetation types showing density, lighting, and the distance at which the target was absorbed.

Figure 3. Study Variables by Vegetation Type

Vegetation Type	Photo Point	Density*	Distance	Lighting
Mixed conifer	1	M	300	Side 62°
	7	O	370	Front 69°
	8	O	400	Front 44°
	9	M	450	Diffuse
	12	D	250	Back 62°
	15	D	150	Back 18°
	21	M	300	Side 60°
	23	D	250	Side 72°
	24	D	170	Front 74°
	29	D	240	Back 72°
	31	D	300	Side 60°
	33	M	350	Back 64°
	39	D	150	Back 60°
	40	D	180	Side 67°
	43	D	230	Back 50°
Pine	19	M	450	Back 69°
	22	M	500	Back 26°
	25	M	360	Back 60°
	30	M	200	Back 72°
	32	M	400	Back 42°
	38	O	600	Side 42°
	41	D	225	Back 72°
Fir	2	D	230	Back 68°
	26	D	250	Side 48°
	27	D	250	Back 37°
	28	D	120	Front 31°
	35	M	250	Back 76°
Lodgepole pine	13	M	300	Side 72°
Broadleaf	5	M	475	Side 50°
	6	D	100	Back 60°
	42	D	160	Front 72°
Herbaceous	16	O	750	Side 11°

* Based on visual judgment upon standardized black and white photographic enlargements.

3. Data Base

   a. Data Summary (Figure 4)

      Average distances for all vegetation types studied

   b. Examples (Figures 5 and 6)

      Selected photo points which demonstrate field technique

Figure 4. Visual Absorption by Vegetation Type and Relative Vegetation Density

Vegetation Type	Photo Point	Vegetation Density	Distance	Average Distance
Herbaceous		Open	750'	750'
Broadleaf		Moderate	475'	475'
		Dense	100	
			160	130'
Pine		Open	600'	600'
		Moderate	450	
			500	
			360	
			200	
			400	325'
		Dense	225	225'
Mixed conifer		Open	370'	
			400	385'
		Moderate	300	
			300	
			300	300'
		Dense	250	
			150	
			250	
	29			
	31		300	
	33		350	
	39		150	
	40		180	
	43		230	227'

Figure 4 (continued)

Vegetation Type	Photo Point	Vegetation Density	Distance	Average Distance
Fir	35	Moderate	250'	250'
	2	Dense	230	
	26		250	
	27		250	
	28		120	215'
Lodgepole pine	13	Moderate	300	300'

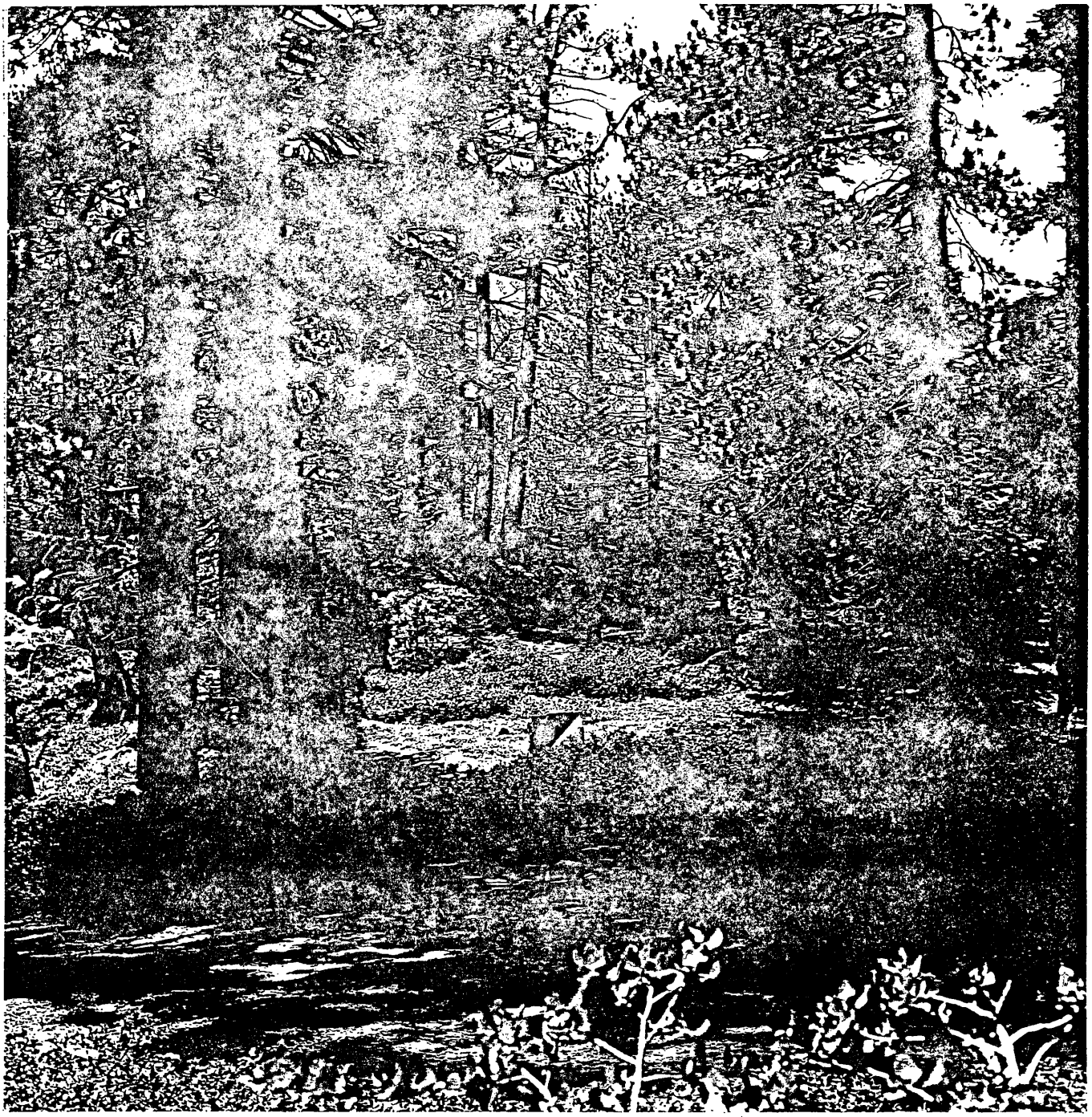

Figure 5 (PHOTO POINT 8)
Field Technique
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	OPEN
Photo Bearing	S 70° W
Distance	135'

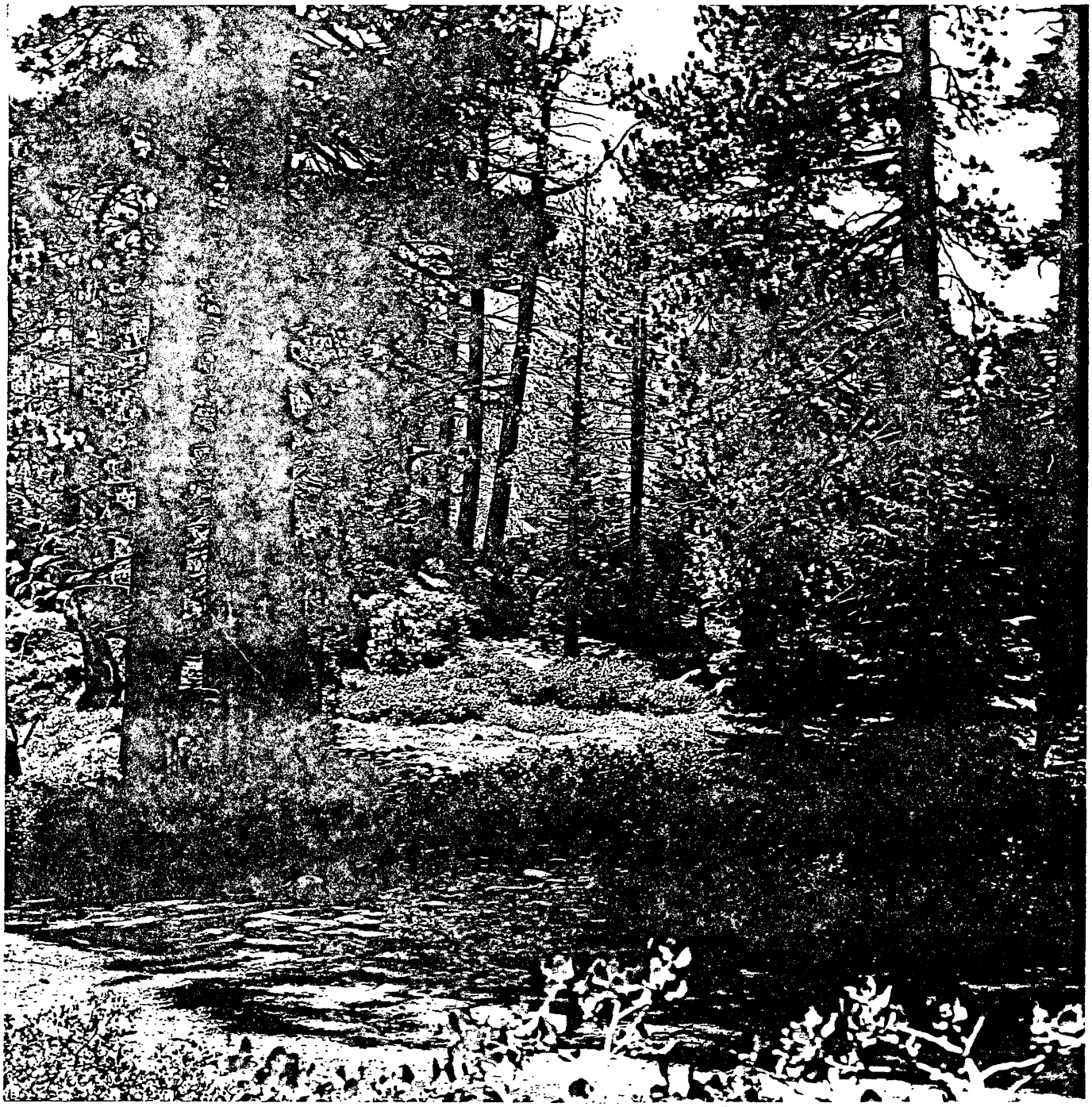

Figure 6 (PHOTO POINT 8)
Field Technique
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	OPEN
Photo Bearing	S 70° W
Distance	400'

CONCLUSION

This study has attempted to develop information concerning both the conditions which affect and the actual capacities for various forest types to visually absorb manmade objects. Vegetation density appears to be the most significant factor affecting absorption thus, one could conclude, vegetation conditions of low vegetation density are more sensitive or vulnerable for visual impact from manmade objects than vegetation conditions of a higher relative density. Forest type and lighting conditions do not appear to affect absorption to the extent that they could be determined in this study. The distances presented on pages 5 and 12, 13 are a preliminary determination of a dimension (or zone) which should be considered of critical importance for maintaining the local continuity of the forest landscape. The criticisms and therefore further directions of study relate to the usefulness of this information and improved techniques for study.

STUDY APPLICATIONS

1. Qualify Scale of Study
    a. Site specific, foreground considerations only
    b. Subregional, middleground - an appropriate scale for vegetation classifications similar to TRPA.
    c. Regional, background or distant view problems such as ski areas and other large land developments. An integration of visual considerations on all three levels is necessary to maintain the continuity of the landscape.

2. Relate Study to Current Planning Studies
    a. TRPA land capability classes
    b. TRPA zoning ordinances
    c. Visual analysis considerations of visual units, landscape sensitivity or vulnerability

SUGGESTED CHANGES, REVISIONS IN STUDY TECHNIQUE

1. Use Actual Manmade Objects
    a. Houses, roadways, and automobiles
    b. Powerlines, ski runs, and parking lots
    c. A portable banner to approximate the main face of a structure
2. Simplify variables
    a. E.g., do all photography between 10 a.m. and 2 p.m. on sunny days on nearly level terrain, use northerly bearing if not due north (the latter points suggesting the Tahoe Basin is a poor study area)
    b. Eliminate the mixed conifer vegetation type because of its variable characteristics and make use of "pure" types, such as, red fir, Jeffrey pine, etc.
3. Make use of specific vegetation transects laid out by other researchers
    a. To provide vegetation detail not provided by TRPA vegetation type map and photo points.
    b. To have adequate definitions of density and stand condition
    c. To assess the effects of overstory and understory components
4. Reassess "vegetation density judgment" re selected photo points
    a. Using experts' evaluation
    b. Potential of salvaging some values within present photo samples

APPENDIX A

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APPENDIX B

COMPARATIVE DATA FROM HANSEN'S REPORT

1. Comparative Photo Point Data (Figure E)
2. Comparison of Physical Variables (Figure F)
3. Visual Obscurity Comparison Between Woody and Leafy Photo Points (Figure G)
4. Main Line of Site/Compass Variations of Differing Points (Figure H)
5. Groupings for Shot Comparison (Figure I)
6. Comparison of Counter Sequence Points (Figure K)
7. Mixed Conifer Point Comparisons (Figure L)

FIG. (E)

(1) COMPARATIVE PHOTO POINT DATA

(A) PHOTO PTS. AND GENRL. TREE TYPES	(B) SHOT DISTANCES MAX. PT.	MED. PT.	CLOSE PT.	(C) OBLIQUE SHOTS 2/3	1/3	(D) LIGHT LOCO.	(E) FT. CANDLE READING	(F)* TOPO	(G)* ON SITE DENSITY, AGE	(H) UNDERSTORY DENSE	MED	SPRS.	(I) TAHOE REGIONAL PLANNING AGENCY SOURCE-TECHNICAL COMMITTEE * 1971 MAP INFORMATION VEG. TYPES	HEIGHT-DENSITY
(1) MIXED CON.	300'	230'	140'	25'/25'	NR	BACK	31	GRAD SLOPE	MED./40-50			✓	MIXED CON. J, Ŵ	C/1244
(2) Ŵ	230'	155'	(75') 70'	30'/40'	80'/15'	OVERHEAD	4	SLIGHT SLOPE	DENSE/50+			✓	" " J, Ŵ, Ā	C/3244 (H/1013)
(3) J	420'	280'	140'	70'/NR	NR/60'	BACK	15	FLAT	DENSE/40+			✓	PINE J, Atr	C/2144
(4) J	420'	280'	140'	70'/NR	NR/70'	FRONT	4.5	FLAT	DENSE/40+			✓	" J, Atr	C/2144
(5) Ā	475'	325'	150'	65'/80'	80'/45	SIDE	70+	FLAT	MED SPARSE/30		✓		MIXED CON. J, Ŵ, Ā (Md)	G (S) (C)
(5) WILLOW/ALDER	100'	66'	33'	33'/33'	NR/15'	SIDE	70+	FLAT	DENSE/1-5	✓			" " J, Ŵ, Ā (Md)	G (S) (C)
(7) MIXED CON.	370'	225'	110'	75'/50'	NR	OVERHEAD	70+	FLAT BROW OF HILL	SPARSE/			✓	LODGEPOLE J, L	C/3233 (G)
(8) " "	400'	275'	135'	75'/75'	75'/75'	OVERHEAD	38	ROLLING	SPARSE/MIXED		✓		MIXED CON J, Ŵ	C/2344 (C/3144)
(9) " "	450'	350'	225'	40'/40'	100'/NR	SIDE	70+	30° UPSLOPE	MED./60+		✓		" " J, Ŵ (PINE J, Qv, Ap)	C/3234
(10) L	300'	200'	100'	50'/50'	50'/50'	FRONT	8	FLAT	MED DENSE/MIXED	✓			FIR L, Ŵ R̂	C/2144
(11) L	300'	200'	100'	50'/50'	50'/50'	SIDE	15-20	FLAT	"		✓		" L, Ŵ R̂	C/2144
(13) L	300'	200'	100'	50'/50'	50'/50'	OVERHEAD	35	DOWN SLOPE	"		✓		" L, Ŵ, R̂	C/2144
(12) MIXED CON. Ŵ	250'	150'	75'	70'/70'	50'/50'	SIDE/OVER.	7	FLAT	MED/25-30			✓	" L, Ŵ, R̂	C/3133
(14) Y	350'	250'	125'	75'/75'	75'/100'	FRONT	30-45	FLAT	SPARSE/OLD			✓	PINE J, Atr	C/2144
(15) MIXED CON	150'	100'	50'	35'/35'	35'/35'	BACK/SIDE	10	FLAT	DENSE/MIXED	✓			MIXED CON. J, Ŵ, Ā	S/0003
(16) GRASSLAND	750'	500'	250'	(100?)	(50)	SIDE	35	FLAT	SPARSE/MIXED		✓		MONTANE CHAPARRAL Qv, Ap	C/3244
(17) MONTANE CHAPARRAL	160'	100'	50'	75'/75'	50'/50'	OVERHEAD	N.R.	20° SIDESLOPE	SPARSE/40	✓			" Qv, Pt, Ap, Cs	C/3224
(18) MIXED CON.	300'	200'	100'	100'/100'	100'/100'	FRONT	N.R.	FLAT	MED/MIXED			✓	PINE J, Atr	C/3244 (C/2133)
(19) Y	450'	300'	150'	75'/75'	75'/75'	FRONT/OVERH.	N.R.	FLAT	SPARSE/±25			✓	" J, Atr	C/3124 (G)
(20) MIXED CON.	120'	80'	40'	35'/35'	35'/35'	BACK/OVERH.	70	SL. SLOPE	HEAVY/1-5	✓			MONTANE CHAPARRAL Ap	S/1 (C)
(21) MIXED CON	300'	200'	100'	60'/60'	60'/50'	FRONT/OVERH.	42	FLAT	MED./MIXED		✓		FIR Ŵ	C/3234
(22) MIXED Y	500'	332'	166'	150'/150'	150'/150'	SIDE/FRONT	N.R.	35° UPHILL SLOPE	MED./±25		✓		FIR R̂ Ŵ	BURN (C/2124)

*(F) SEE SECTIONS

*(G) SEE CHART COMPARING ON-SITE DATA * T.R.P.A. MATERIAL

*(I) VEG. TYPE SYMBOL KEY:

J = PINUS JEFFREYI
Ŵ = ABIES CONCOLOR
Ā = POPULUS TREMULOIDES
Atr = ARTEMISIA TRIDENTATA
L = PINUS CONTORTA MURRYANA
R̂ = ABIES MAGNIFICA
Ap = ARCOSTAPHYLOS PATULA
Ccu = CEANOTHUS CORDULATOS
Qv = QUERCUS VACINIFOLIA
Pt = PURSHIA TRIDENTATA
Cs = CASTANOPSIS SEMPERVIRENS
Md = MEADOW
Y = PINUS PONDEROSA

HEIGHT-DENSITY KEY A/BCDE:

(A) STRUCTURE CLASS
C = CONIFER G = GRASS
H = HARDWOOD B = BARREN
S = SHRUB

(B) DOMINANT SIZE-HEIGHT CLASS
3 = 22"+DIAM., 75'+ HGT.
2 = 11-22" , 25'-75'
1 = 0-11" , 0-25'
(LAND COVER)

(C) SECONDARY SIZE-HEIGHT CLASS (CONIFERS)
3 = 22"+ DIAM, 75'+ HEIGHT
2 = 11-22" DIAM., 25'-75' "
1 = 0-11" DIAM., 0'-25' "

(D) CROWN COVER (BASAL DENSITY-CONIFERS ONLY)
4 = 70-100% OF LAND 2 = 10-40%
3 = 40-70% OF LAND 1 = 0-10%

(E) TOTAL COVER (BASAL DENSITY-CONIFER, HARDWOOD SHRUBS)
4 = 70-100% OF LAND 2 = 10-40% OF LAND
3 = 40-70% OF LAND 1 = 0-10% OF LAND

FIG. (11)

(2) COMPARISON OF PHYSICAL VARIABLES

PHOTO POINT & VEGET. TYPE	TARGET ON CENTER SHOT / MAIN DIRECTION * TARG. SHADY	TARG. SUNNY	TARG. CLEAR	TARG. OBSC.	TARG. P. OBSC.	DIRECTION	TARGET ON LEFT OBLIQUE CENTER * TARG. SHADY	TARG. SUNNY	TARG. CLEAR	TARG. OBSC.	TARG. P/OBSC.	DIRECTION	TARGET ON RIGHT OBLIQUE CENTER * TARG. SHADY	TARG. SUNNY	TARG. CLEAR	TARG. OBSC.	TARG. P/OBSC.	DIRECTION	TIME OF DAY 5-10 AM	10-3	3-7 PM	SUN ANGLE HIGH	LOW	SIDE	BACK	FRONT	FOOT CANDLE READING	COMMENTS ON BRIGHTNESS & SHADOW INTENSITY
(1) MIXED CON.	✓				✓	S20°W				✓		S20°W		✓			✓	S40°W		✓		✓			⋰		31	SHADOWS QUITE PREDOMINANT
(2) Ŵ	✓				✓	N35°W	✓		✓					✓	✓					✓		✓		✓			4	MOD. SHADOWS ALTERNATING W/ SUNNY STRIPS
(3) J	✓				✓	N60°W	✓				✓					✓					✓	✓			⋰		15	MOSTLY DARK SHADOW MOTTLED SUN.
(4) J	✓			✓		S80°E					✓					✓					✓		✓			✓	4.5	HIGH CONTRAST SUN & SHADE
(5) Ā	✓					N20°W		✓			✓		✓		✓				✓			✓		✓			70+	VERY SUNNY, WHITE TRUNKS
(6) WILLOW/ALDER					✓	N20°W					✓						✓			✓		✓		✓			70+	V. SUNNY, TARGET PRACTICALLY OBSCURE ON COLOR
(7) MIXED CON.		✓	✓			S10°E	✓		✓					✓			✓			✓		✓			⋰		70+	VERY SUNNY HIGH CONTRAST SHADOWS
(8) " "	✓			✓		S70°W	✓			✓			✓				✓				✓	✓			✓		35	MOTTLED SUN & SHADOW
(9) " "	✓		✓			N60°W	✓			✓			✓				✓				✓		✓	✓			70+	"
(12) " Ŵ		✓		✓		S45°E	✓			✓				✓			✓			✓		✓		⋰			7	SHOT FROM DEEP SHADOW TO SUNNY AREA
(14) Y		✓		✓		E		✓	✓					✓	✓						✓	✓				✓	30-45	MOTTLED BUT NOT HIGH CONTRAST
(15) MIXED CON.	✓				✓	S60°W	✓				✓		✓				✓				✓	✓		⋰			10	DIFFUSE LIGHT NO DISCERNABLE SHADOW
(16) GRASSLAND	✓				✓	S5°W				✓						✓					✓		✓	✓			35	SUN & SHADE LARGE AREAS
(17) MONTANE CHAPARRAL	✓		✓			N45°W	✓		✓				✓				✓			✓		✓		—			BRIGHT	BRIGHT/DIFFUSE LIGHT
(18) MIXED CON.		✓	✓			N30°W	✓				✓			✓	✓					✓		✓				✓	(10)	STRONG CONTRAST LIGHT & DARK PATCHES
(19) Y		✓	✓			N40°W		✓			✓			✓			✓			✓		✓				⋰	70+	STRONG SUN LIGHT UNDERCOVER
(20) MIXED CON.		✓			✓	N40°E		✓		✓				✓			✓			✓		✓				⋰	70	STRONG SUN NO DISCERNABLE SHADOW
(21) " "		✓	✓			N10°W	✓				✓		✓				✓			✓		✓				✓	42	SUNNY/MOTTLED DIFFUSE — SUN VARIABLE
(22) " Y					✓	N60°E					✓						✓				✓	✓				✓	(40)	DIFFUSE LIGHT SHADOW NOT DARK

SEE CHART (1) FOR VEG. SYMBOLS

COMPARISON OF A PHOTO POINT AT DIFFERING TIMES OF DAY (LIGHT SOURCE VARIABLE IN DIRECTION & INTENSITY)

(10)	✓		✓			S70°E	✓				✓	S50°E				✓		S20°W			✓		✓			⋰	8	DIFFUSE LIGHT, NO TRULY DISCERNABLE SHADOWS
(11) LODGEPOLE	✓		✓				✓				✓					✓			✓				✓	✓			17	VERY SHADOWY MOTTLED
(13)		✓			✓			✓			✓					✓				✓		✓		⋰			35	DISTINCTLY SUNNY HIGH CONTRAST

* AS AN AVERAGE, THE CENTER SHOT WAS CHOSEN ON EACH PHOTO POINT FOR BEST COMPARABLE DATA (SEE TEXT).

FIG. (6)

(3) VISUAL OBSCURITY COMPARISON BETWEEN WOODY & LEAFY PHOTO POINTS

GENERALLY WOODY POINTS

WOODY CONNOTES MAJOR PRESENCE OF TRUNKS, BRANCHES, TWIGS, BARK, ETC.

FOREST LANDSCAPE TYPE AND PHOTO PT. NUMBER *	VIEWING POINTS (DISTANCE) LONG	MED	CLOSE	GENERAL DENSITY SPS/MED/DEN	APPROXIMATE TREE AGE	NUMBER OF OBLIQUES NOT SEEN	LIGHT POSITION & FOOT CANDLE READING
Ŵ	230'	155'	70'	DENSE	50 YRS.	2	OVERHEAD 4
J	420'	280'	140'	DENSE	40+YRS.	2	BACK 15
J	420'	280'	140'	DENSE	40+YRS.	3	FRONT 4.5
Y	350'	250'	125'	SPARSE	80+YRS.	0	FRONT 30-45
MIXED CON.	300'	200'	100'	MEDIUM	MIXED	0	FRONT N.R.
" "	300'	200'	100'	MEDIUM	80 YRS.	0	FRONT/OVER. 42
" Y	500'	332'	166'	MEDIUM	25+YRS.	1	SIDE/FRONT N.R.

SEE CHART (1) FOR VEG. SYMBOLS

TOTALS (AVERAGES)

7 POINTS	360'	242'	120'	1 SPARSE 3 MEDIUM 3 DENSE	± 50 YRS	1.15/POINT	20 ± F.C. 5 FRONT 1 BACK 1 OVERHEAD

GENERALLY LEAFY POINTS

LEAFY CONNOTES MAJOR PRESENCE OF LEAVES, NEEDLES, GRASS, BRUSH, ETC.

FOREST LANDSCAPE TYPE & PHOTO PT. NUMBER *	VIEWING POINTS (DISTANCE) LONG	MED.	CLOSE	GENERAL DENSITY SPS/MED/DEN	APPROXIMATE TREE AGE	NUMBER OF OBLIQUES NOT SEEN	LIGHT POSITION AND FOOT CANDLE READING
(1) MIXED CON.	300'	230'	140'	MEDIUM	50 YRS.	2	BACK 31
(6) WILLOW/ALDER	100'	66'	33'	DENSE	1-5 YRS.	1	SIDE 70
(16) GRASSLAND	750'	500'	250'	SPARSE	MIXED	0	SIDE 35
(17) MONTANE CHAPARRAL	150'	100'	50'	SPARSE	40 YRS	0	OVERHEAD N.R.
(20) MIXED CON.	120'	80'	40'	DENSE	1-5 YRS	1	BACK/OVERH. 70

TOTALS (AVERAGES)

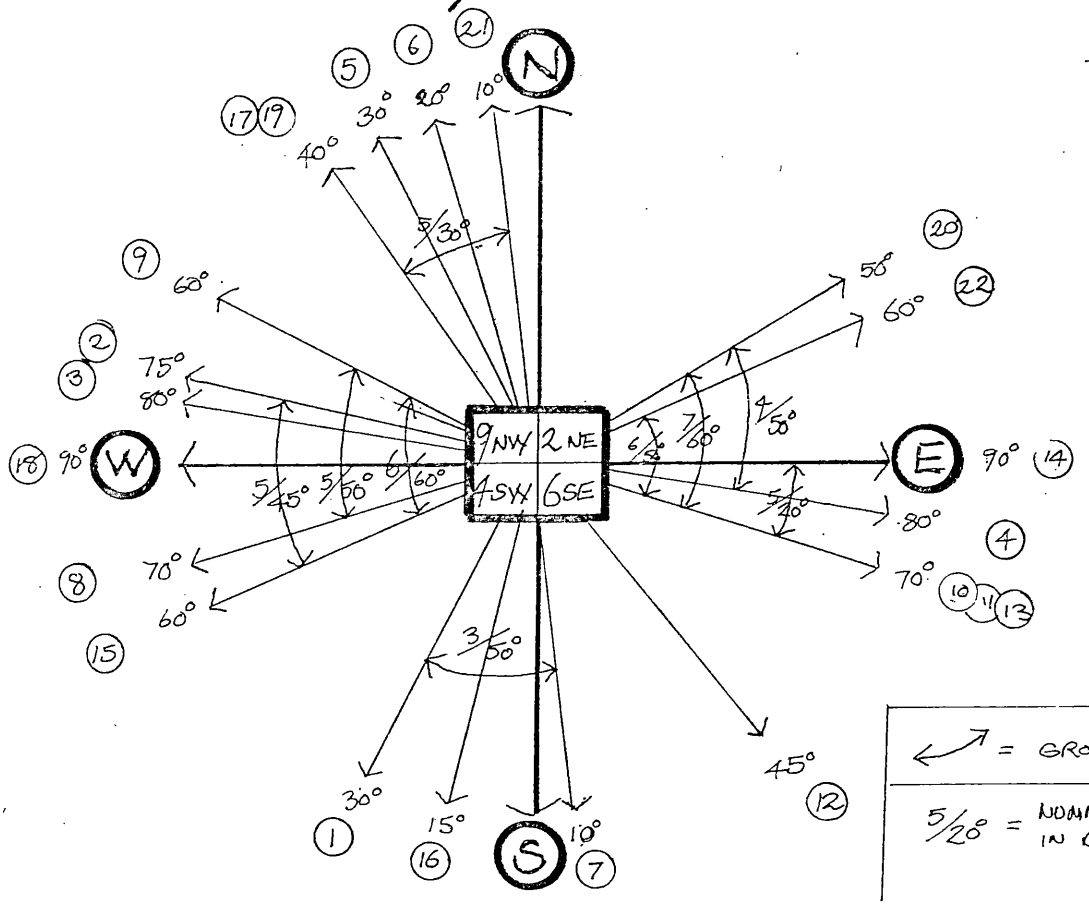
5 POINTS	284'	199'	102'	2 SPARSE 1 MED. 2 DENSE	±24 YRS.	.75/POINT	50± F.C. 2 SIDE 2 BACK 2 OVERHEAD

TOTALS OF OTHER POINTS (NO PREDOMINANCE OF WOODINESS OR LEAFINESS)

(5)(7)(8)(9)(12) ALL BUT (5) ARE MIXED CON.	AVG. VIEWING DISTANCE			GENERAL DENSITY	±35 YRS OF AGE	.5/POINT OBLIQUES INVISABLE	±50 FOOT CANDLE READING SIDE/OVERHEAD
	389'	255'	139'	3 SPARSE, 3 MEDIUM, 1 DENSE			

CONCLUSIONS: ALTHOUGH DATA FOR THIS COMPARISON IS SPARSE IT IS APPARENT THAT AT POINTS OF A MORE LEAFY CHARACTER VISUAL ACUITY IS LESSENED THAN AT POINTS WHERE WOODINESS IS PREDOMINANT. CERTAINLY LINES OF SIGHT ARE IMPEDED MORE AT LEAFY POINTS AS WITNESS THE ±50' DIFFERENCE IN AVERAGE DISTANCES THE TARGET WAS SIGHTED. AGE SEEMS TO BE A FACTOR W/GENERALLY WOODY PTS. HAVING AN AVERAGE OF ± 50 YRS AND LEAFY POINTS AT ±24 YRS. LIGHT INTENSITY SEEMS NOT TO HAVE BEEN A FACTOR AS THE LEAFY POINTS HAD THE HIGHER FOOT CANDLE READING. SUMMER/WINTER DIFFERENCES MAY BE A FACTOR AT DECIDUOUS POINTS AS OBVIOUSLY VISUAL ACUITY WOULD BE HIGHER IN WINTER AT THESE POINTS. MORE DATA IS NEEDED HERE.

(4) MAIN LINE OF SIGHT / COMPASS VARIATIONS OF DIFFERING PTS.



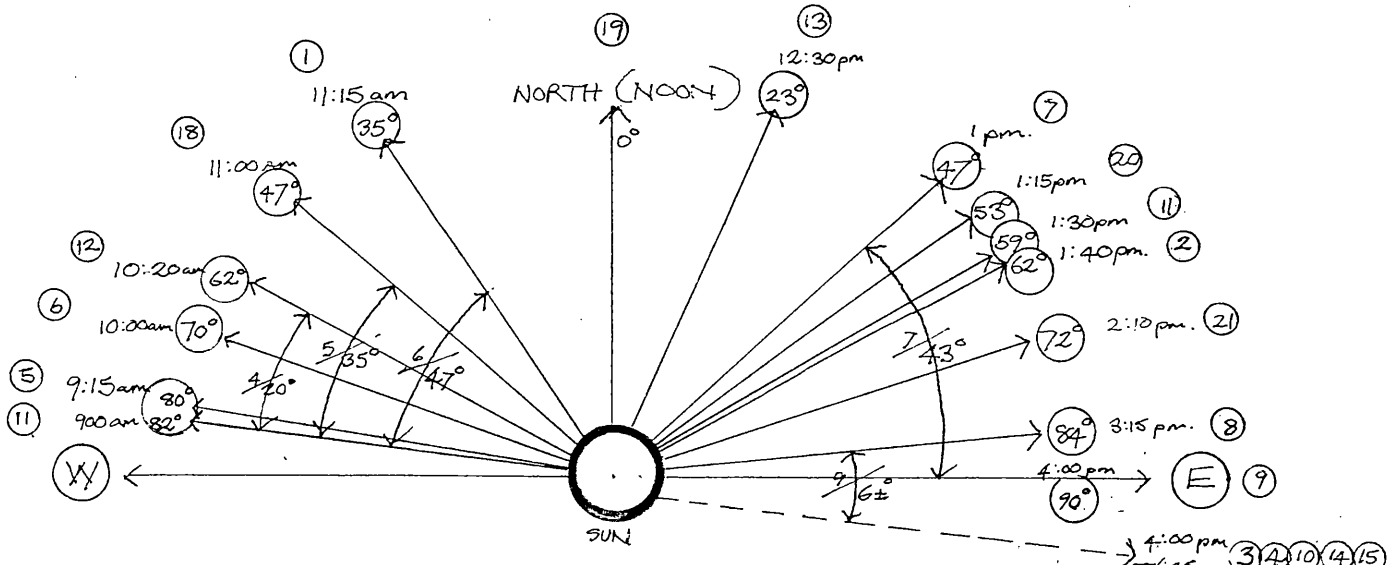
RANKING OF SHOTS AND DEGREE RANGE

5/20°
5/30°
5/45°
6/50°
5/50°
4/50°
7/60°
6/60°
3/50°

↙↗ = GROUPING OF SHOTS

5/20° = NUMBER OF SHOTS IN DEGREE RANGE.

HORIZONTAL SUN ∠ AS A CRITERIA FOR POINT COMPARISON

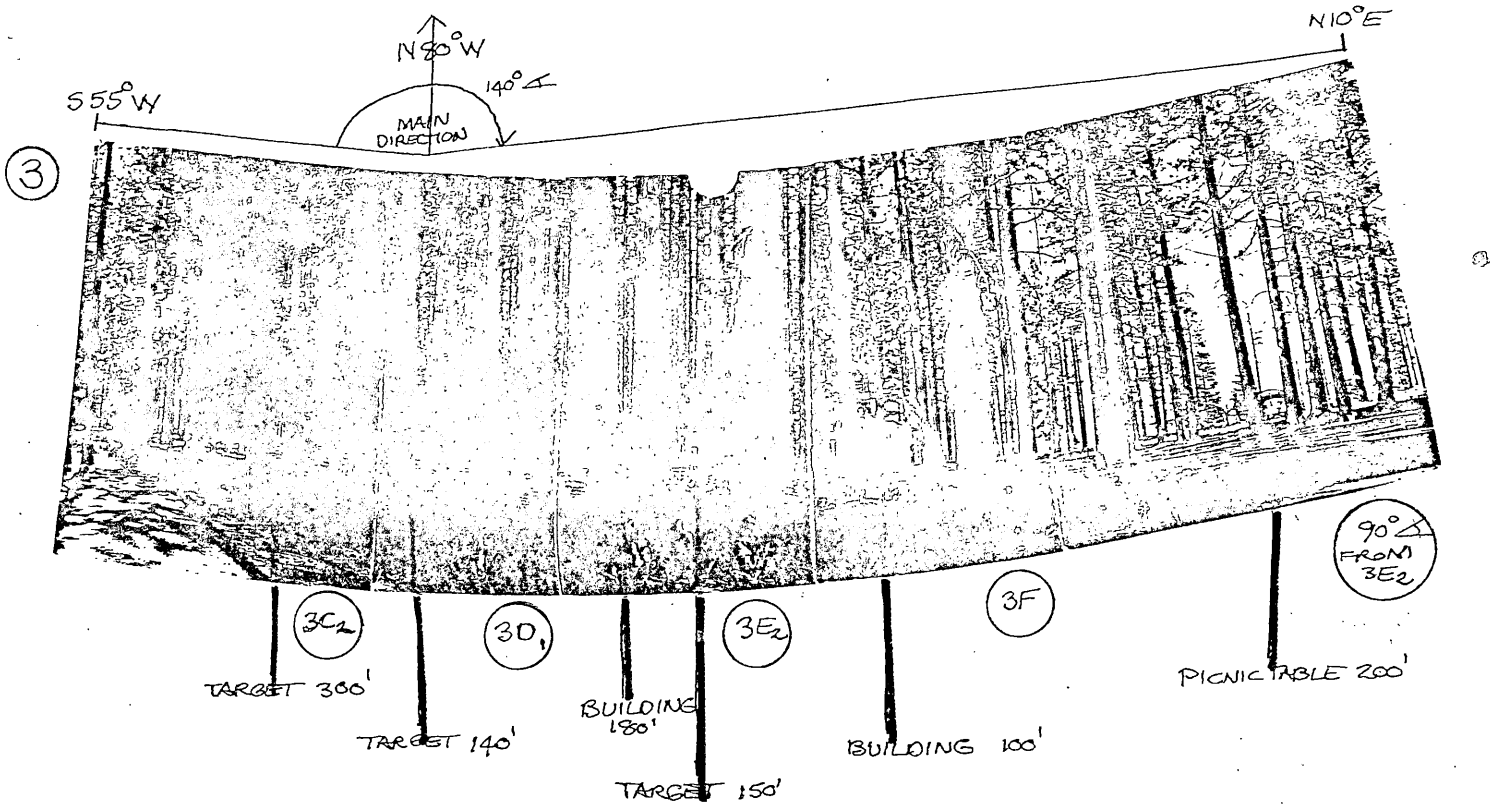


→ SUN DIRECTION

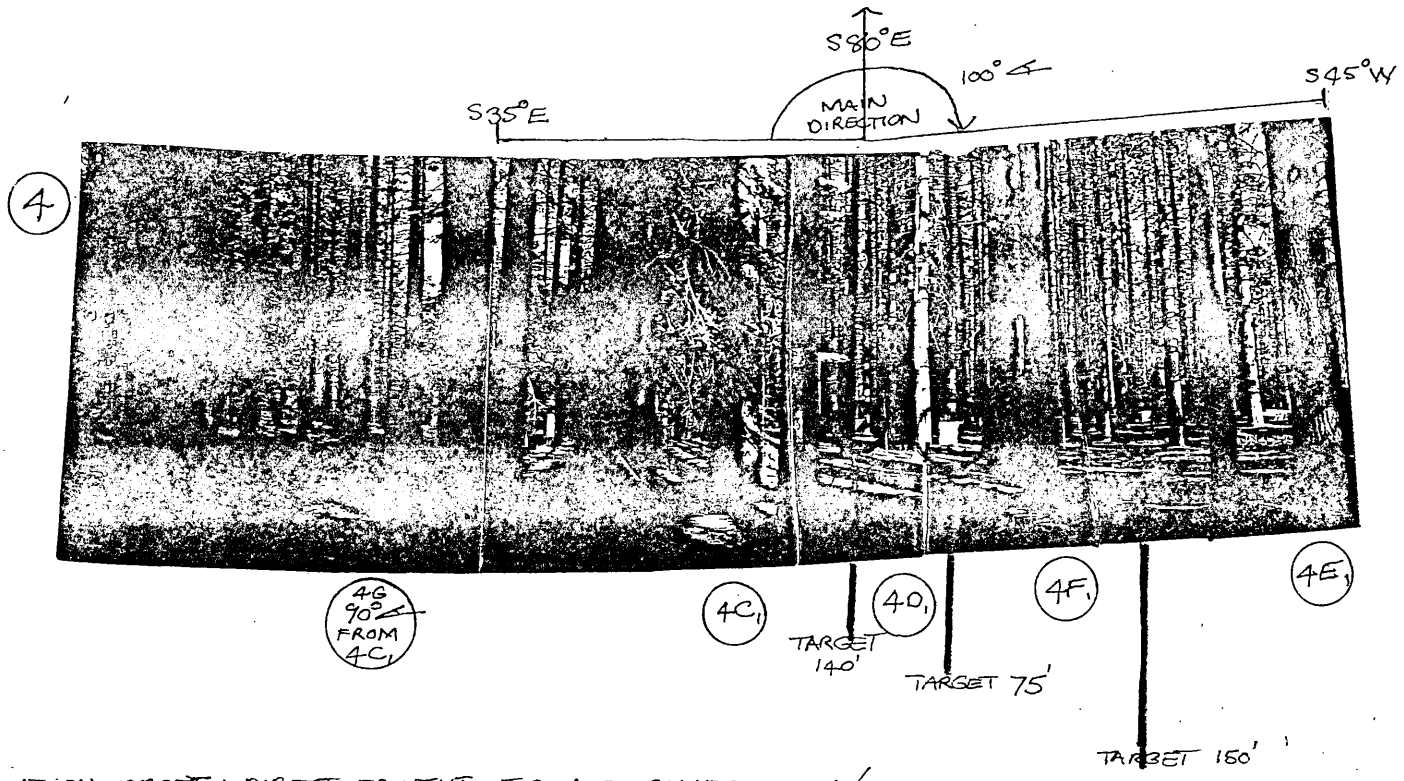
(5) GROUPINGS FOR SHOT COMPARISON

	SHOT DIRECTION △° RANGE	TOPOGRAPHY	HORIZONTAL SUN △°	TIME		VEGETATION	WEATHER / LIGHT
	FOR BEST COMPARISON THE IDEALS ARE THE FOLLOWING:						
	NARROWEST △° RANGE FOR GREATEST NO. OF SHOTS	AS SIMILAR AS POSSIBLE	NARROWEST △° RANGE	LEAST DIFFERENCE (2 HRS?)		AS DIVERSE AS POSSIBLE (DEPENDING ON COMPARISON)	SIMILAR CONDITIONS & FOOT CANDLES
A	30° (5) N 30° W	FLAT	N 80° W	9:15 AM		ASPEN	SUN 70+
	(6) N 20° W	FLAT	N 70° W	10:00 AM		YNG. ALDER	" 70+
	(17) N 40° W	SLIGHT SLOPE	N 59° E	1:30 PM	3:30 HRS.	SCRUB	CLOUDY N.R.
	(19) N 40° W	FLAT	N	12:00 NOON		YNG. PINE	SUN N.R.
	(21) N 10° W	FLAT	N 53° E	1:15 PM		OLD CEDAR	" 42
	TOTALS 5 POINTS, 4/FLAT 1/SLSL., 139° RANGE, 4:15 HRS RANGE, DIVERSE, 4 SUN / 1 CLOUD						
B	45° (2) N 75° W	SLIGHT SLOPE	N 62° E	1:40 PM.	4:05 HRS.	FIR TRUNKS	SUN 4
	(3) N 80° W	FLAT	± 90° E	5:00 PM		PINE "	" 15
	(8) S 70° W	ROLLING	N 84° E	3:15 PM		MIXED CON.	" 38
	(15) S 60° W	FLAT	± 90° E	5:45 PM.		" "	" (NOT VISABLE) 10
	(18) N 90° W	FLAT	N 47° W	11:00 AM.		" "	" NR.
	TOTALS 5 POINTS, DIVERSE, 137° RANGE, 6:45 HRS RANGE, SIMILAR, 5 SUN						
C	20° (4) S 80° E	FLAT	± 90° E	5:30 PM		PINE TRUNKS	SUN 4.5
	(10) S 70° E	"	"	6:45 PM		" (CORRIDOR)	CLOUDY 8
	(11) S 70° E	"	N 82° W	9:00 AM		" "	SUN 15-20
	(13) S 70° E	"	N 23° E	12:30 PM		" "	" 35
	(14) EAST	"	± 90° E	4:45 PM		" TRUNKS	" 30-45
	TOTALS 5 POINTS, 5 FLAT, 172° RANGE, 9:45 HRS. RANGE, SIMILAR, 4 SUN / 1 CLOUD						
D	50° (2) N 75° W	SLIGHT SLOPE	N 62° E	1:40 PM	3:20 HRS.	FIR TRUNKS	SUN 4
	(3) N 80° W	FLAT	± 90° E	5:00 PM		PINE "	" 15
	(8) S 70° W	ROLLING	N 84° E	3:15 PM.		MIXED CON.	" 38
	(9) N 60° W	STEEP SLOPE	N 90° E	4:00 PM.		" "	" (HAZE) 70+
	(18) N 90° W	FLAT	N 47° W	11:00 AM.		" "	" N.R.
	TOTALS 5 POINTS, DIVERSE, 137° RANGE, 6:00 HRS. RANGE, SIMILAR, 5 SUN						
E	60° (4) S 80° E	FLAT	± 90° E	5:30 PM.		PINE TRUNKS	SUN 4.5
	(10) S 70° E	"	"	6:45 PM		" (CORRIDOR)	CLOUDY 8
	(11) S 70° E	"	N 82° W	9:00 AM		" "	SUN 15-20
	(13) S 70° E	"	N 23° E	12:30 PM		" "	" 35
	(14) EAST	"	± 90° E	4:45 PM		" TRUNKS	" 30-45
	(20) N 50° E	SLIGHT SLOPE	N 53° E	1:15 PM		MIXED CON.	" 70
	(22) N 60° E	STEEP "	± 90° E	5:00 PM		PINE TRUNKS	" N.R.
	TOTALS 7 POINTS, 5 FLAT / 2 SLOPE, 172° RANGE, 9:45 HRS. RANGE, SIMILAR, 6 SUN / 1 CLOUD						

(6) COMPARISON OF COUNTER-SEQUENCE POINTS (3) & (4) DENSE PINUS JEFFREY, FLAT TOPO, SPARSE UNDERSTORY, 5-5:30 PM., ALL TARGETS SHOWING WHITE/YELLOW SIDE



HT ON TARGET: REFLECTED, BACKLIT, F.C. 15, CAMERA 5.6/250th.



HT ON TARGET: DIRECT, FRONTLIT, F.C. 4.5, CAMERA 5.6/60th

A COMPARISON OF THESE TWO POINTS, TAKEN AT THE SAME TIME OF DAY AND UNDER THE SAME CONDITIONS SHOWS THE AFFECTS OF SUN ∠ ON TARGET DATA (OBJECTS) WITHIN THIS TYPE OF LANDSCAPE. POINT (3) SHOWS DIFFUSE, REFLECTED LIGHT ON THE TARGET AND FOREST IN GENERAL, AND WHILE THE METER VALUES A HIGHER FOOT CANDLE READING IT IS A GENERAL BRIGHTNESS. IN POINT (4) LIGHTS & DARKS ARE MUCH MORE INTENSE WITH THE TARGET OBVIOUSLY VISABLE IN DIRECT SUN AND INVISABLE IN THE SHADE, WITH THE SHADE PREDOMINANT FOREST GIVING A LOWER FOOT CANDLE READING.. POINT (3) TARGETS ARE ALL READABLE BUT INCONSPICUOUS.

(7) MIXED CONIFER POINT COMPARISONS

POINT	VEGETATION TYPES*	AGE/HEIGHT/DENSITY*	UNDERSTORY	LIGHT LOCO & F.C. ROG. & TOPOGRAPHY	MIDLINE TARGET DISTANCES			COLOR VISABILITY RATINGS (MIDLINE TARGET)				
								RED	GREEN	YELLOW	WHITE	OTHE
(1)	J, Ŵ	MEDIUM 40-50 YRS. / C / 1244	MED / SPARSE	BACKLIT / 31 / SL. SLOPE	300'	230'	140'	5	1	4	3	2
(7)	J, L	SPARSE / C / 3233	MED / SPARSE	OVERHEAD / 70+ / SL. SLOPE	370'	225'	110'	5	2	4	3	—
(8)	J, Ŵ	SPARSE MIXED AGE / C / 2344	MEDIUM	OVERHEAD / 38 / ROLLING	400'	275'	135'	5	4	2	3	—
(9)	J, Ŵ	MEDIUM 60+ YRS. / C / 3234	MEDIUM	SIDELIT / 70+ / 30° SLOPE	450'	350'	225'	5	0	3	4	—
(12)	L, Ŵ, R̂	MEDIUM 25-30 YRS. / C / 3133	SPARSE	SIDELIT OVERHD. / 7 / SLOPE	250'	150'	75'	5	3	4	3	3
(15)	J, Ŵ, Ā	DENSE MIXED AGE / S / 0003	DENSE	BACKLIT SIDELIT / 10 / FLAT	150'	100'	50'	5	2	3	4	2
(18)	J, Atr	MEDIUM MIXED AGE / C / 3244	SPARSE	FRONTLIT / N.R. / FLAT	300'	200'	100'	5	3	4	4	4
(20)	Ap	HEAVY 1-5 YRS / S / 1	DENSE	BACKLIT OVERHD / 70 / SL. SLOPE	120'	80'	40'	5	2	3	4	—
(21)	Ŵ	MEDIUM MIXED AGE / C / 3234	MEDIUM	FRONTLIT OVERHD / 42 / FLAT	300'	200'	100'	5	2	4	3	4
9 pts.	J, Ŵ, L	DIVERSE / C / 3234	DIVERSE	MOSTLY BACKLIT (21)	DIVERSE (100 SLOPE)	120'-450'	80'-350'	40'-225'	5.00	2.11	3.44	3.44

(THIS CHART IS NOT YET COMPLETED)

APPENDIX C

BASE DATA PHOTO POINTS

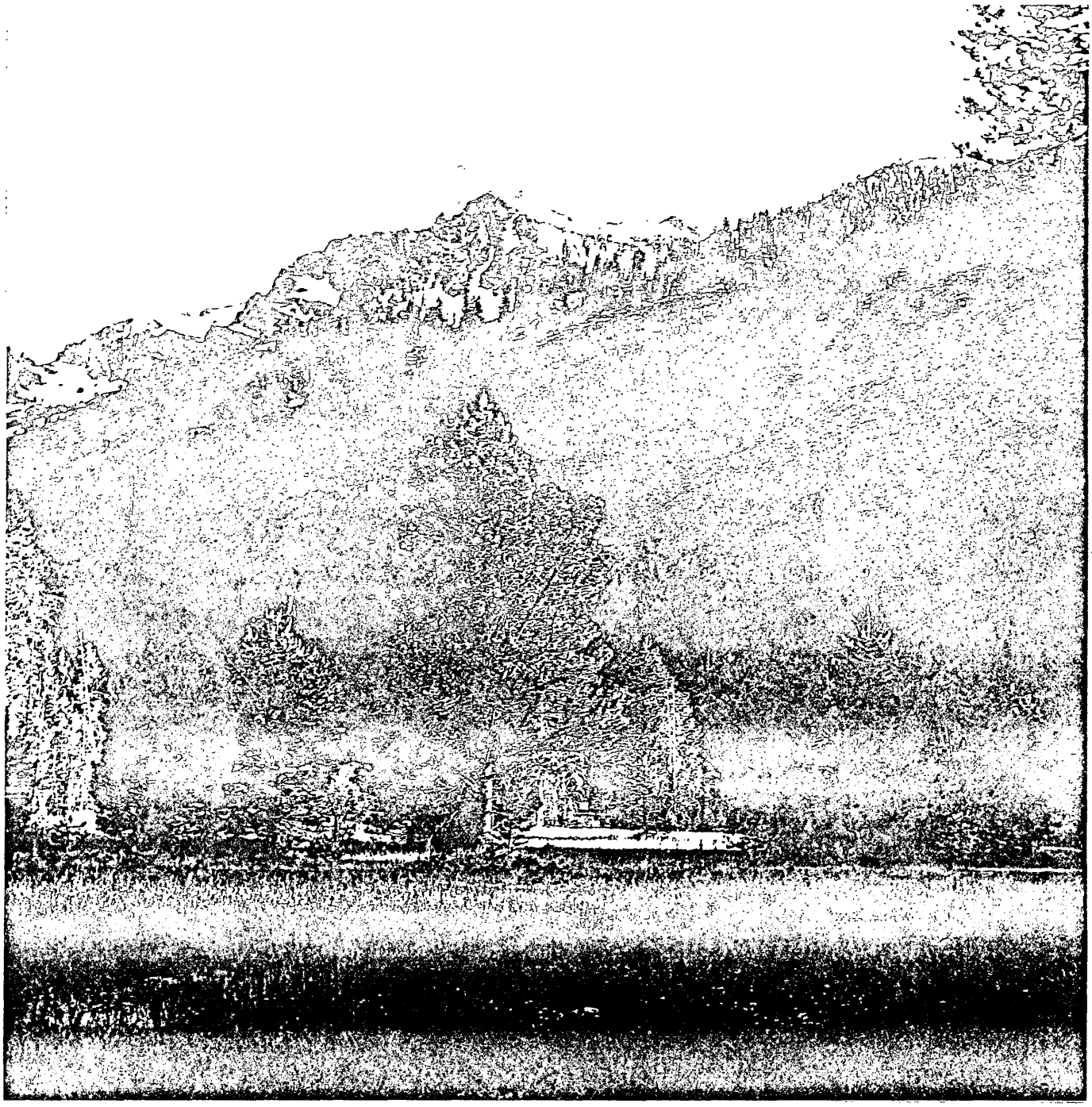


Figure 7
Photo Point 16
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	HERBACEOUS
Veg. Density	OPEN
Photo Bearing	S 15° W
Distance	750'

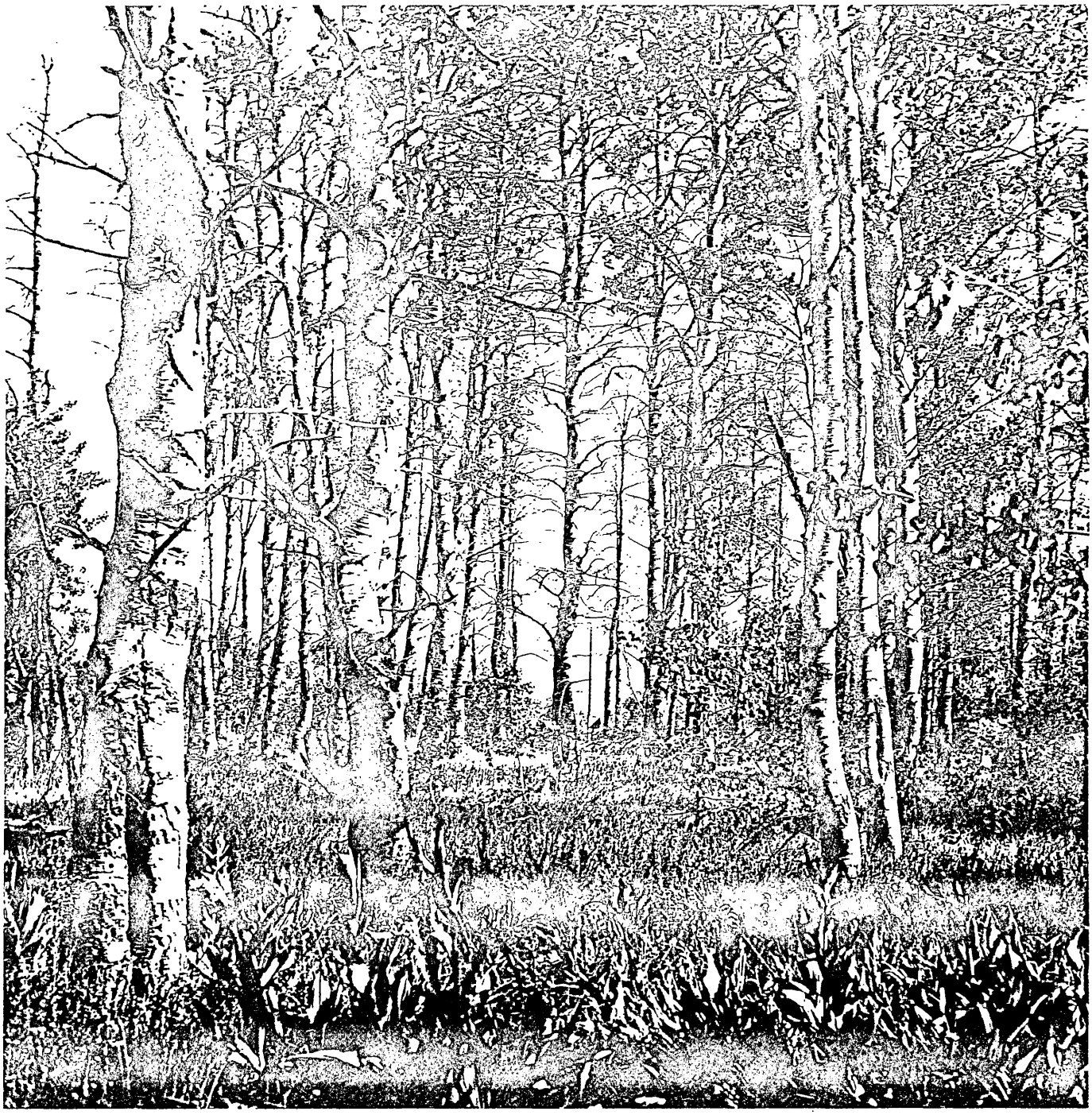


Figure 8
Photo Point 5
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	BROADLEAF
Veg. Density	MODERATE
Photo Bearing	N 30° W
Distance	475'

Figure 9
Photo Point 6
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	BROADLEAF
Veg. Density	DENSE
Photo Bearing	N10°W
Distance	160'

Figure 10
Photo Point 42
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	BROADLEAF
Veg. Density	DENSE
Photo Bearing	S10°W
Distance	120'

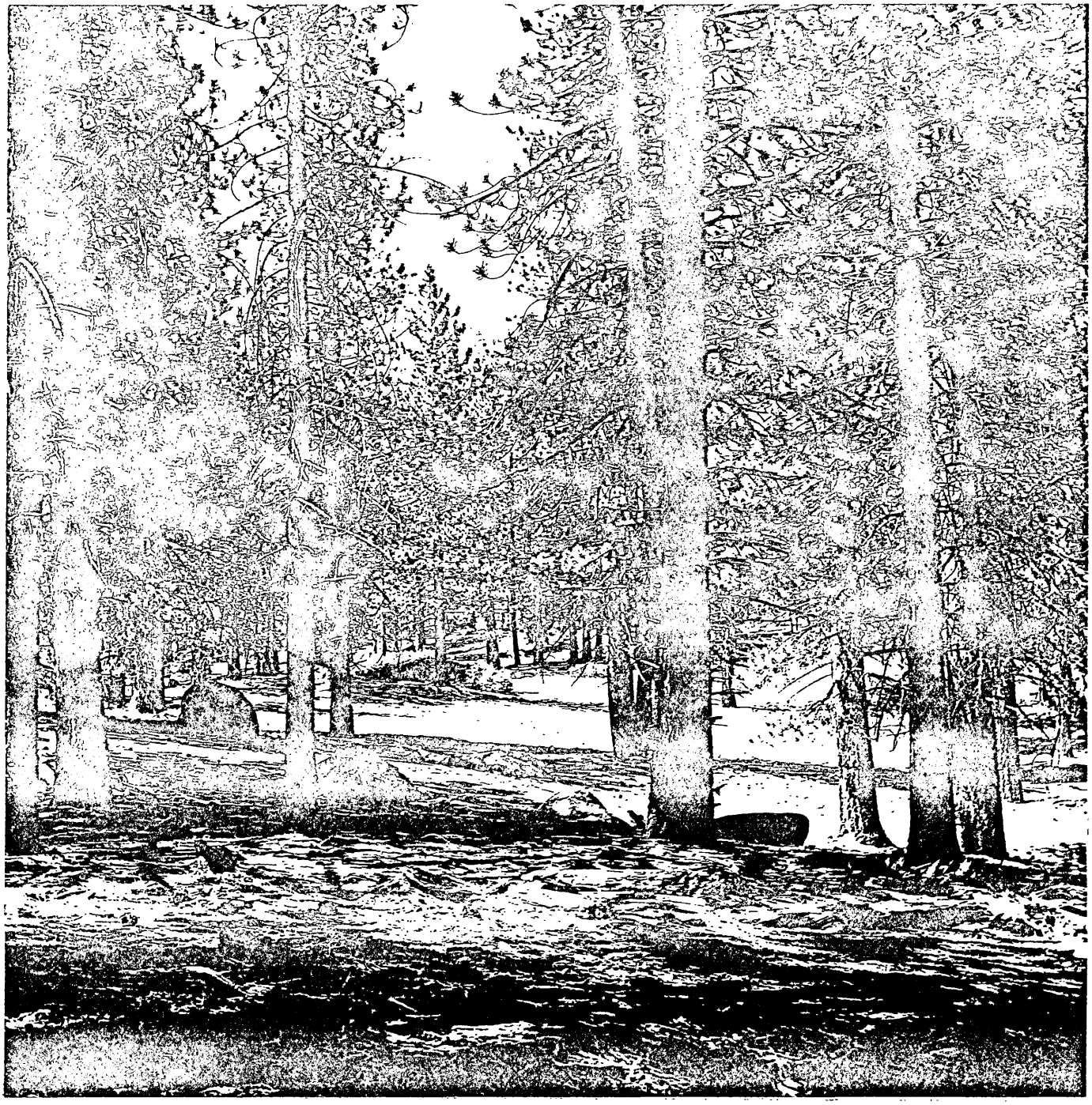


Figure 11
Photo Point 38
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg.Type	PINE
Veg. Density	OPEN
Photo Bearing	NORTH
Distance	600'

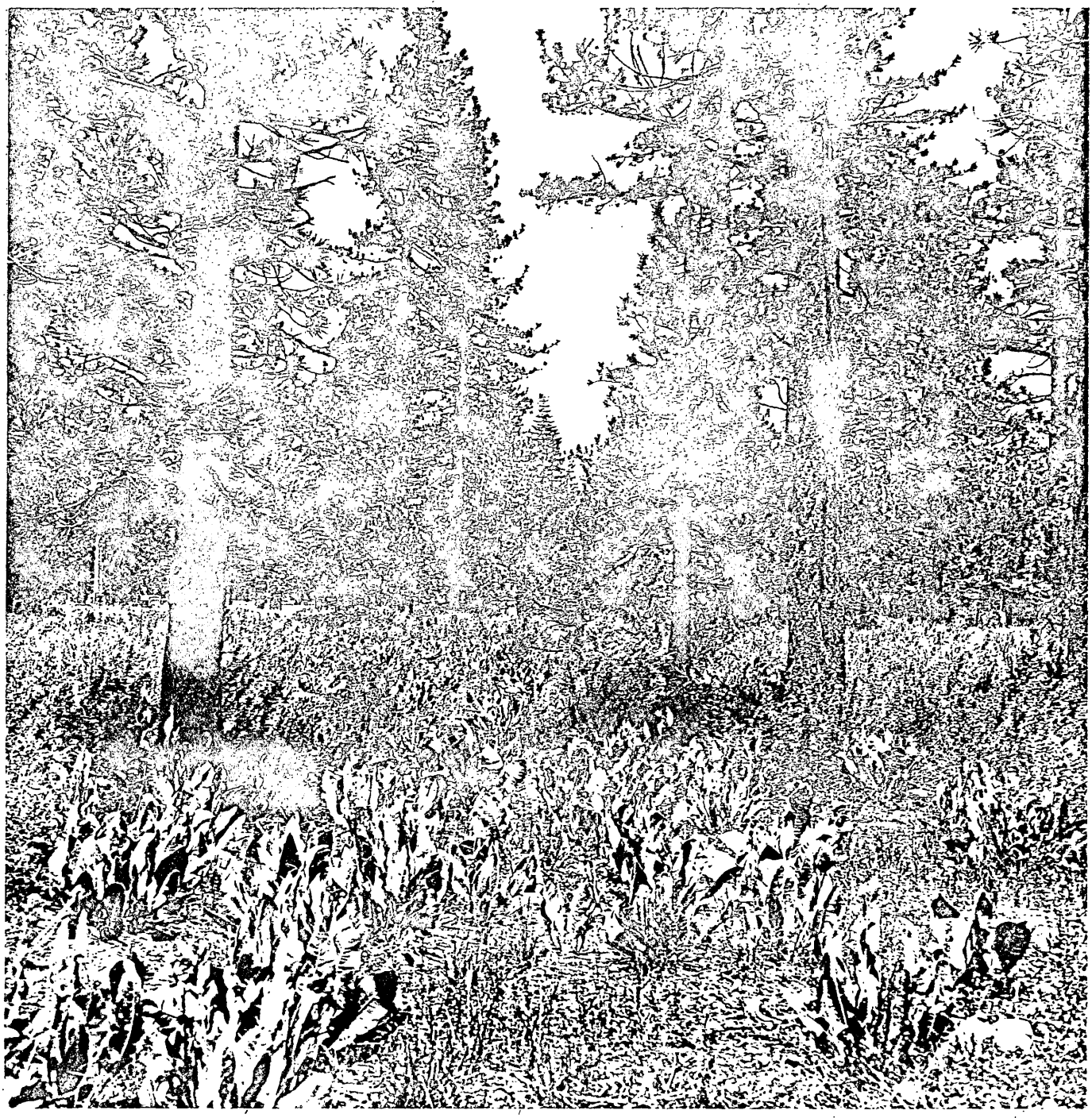


Figure 12
Photo Point 19
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	PINE
Veg. Density	MODERATE
Photo Bearing	N 40° W
Distance	450'

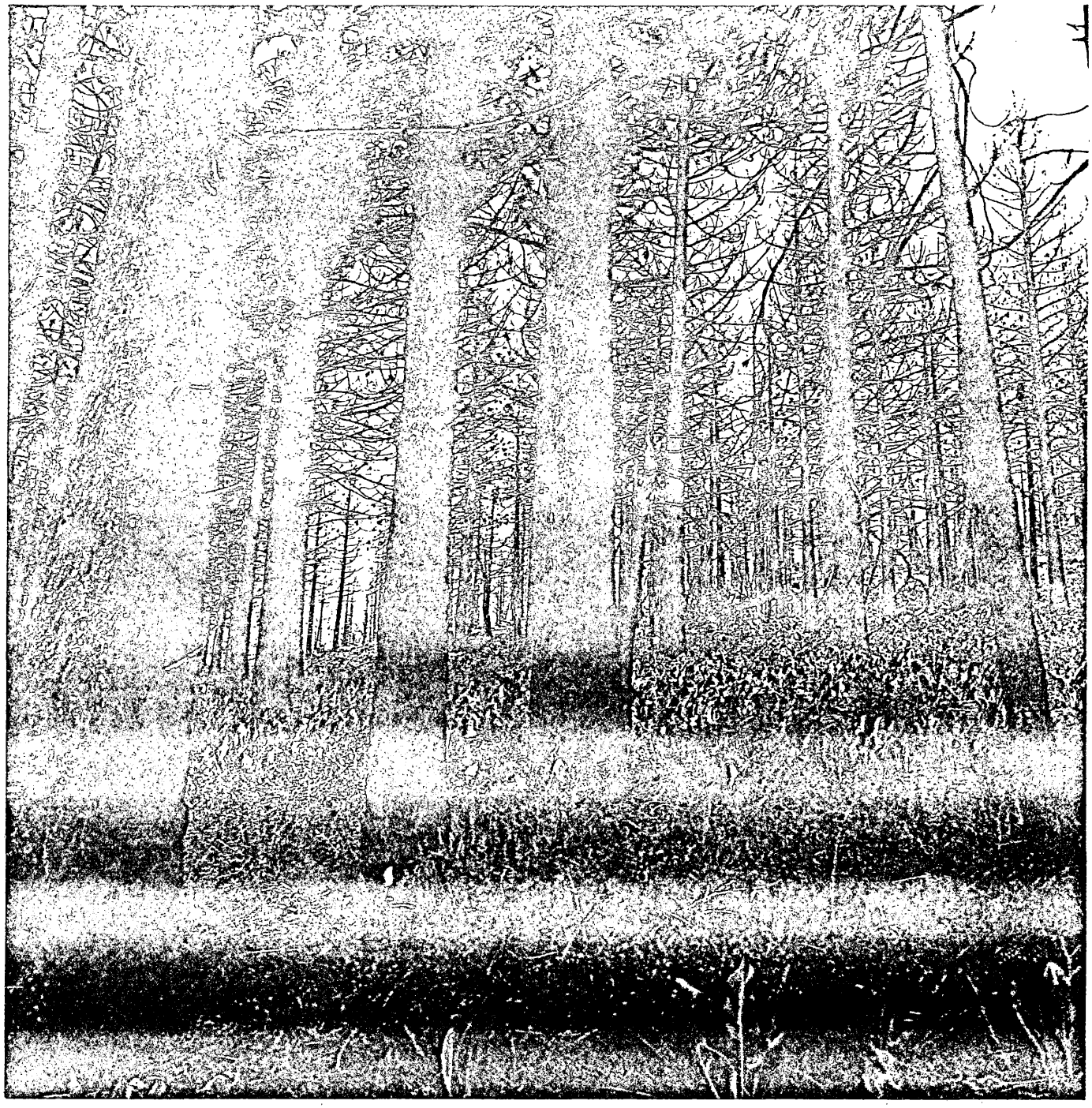


Figure 13
Photo Point 22
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	PINE
Veg. Density	MODERATE
Photo Bearing	N 60° E
Distance	500'

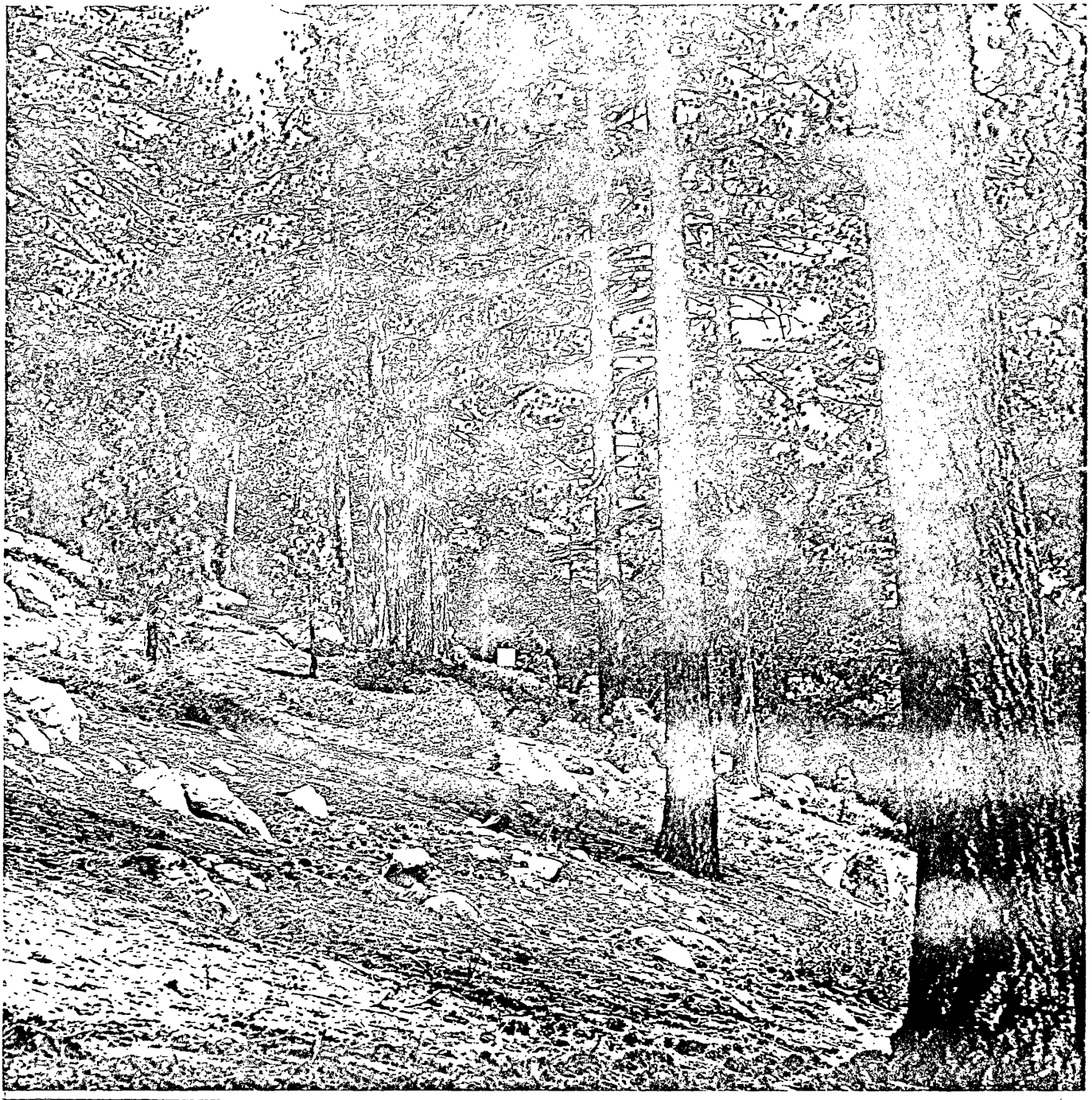


Figure 14
Photo Point 25
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg.Type	PINE
Veg. Density	MODERATE
Photo Bearing	N 70° E
Distance	360'

Figure 15
Photo Point 30
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	PINE
Veg. Density	MODERATE
Photo Bearing	N 20° E
Distance	200'

Figure 16
Photo Point 32
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	PINE
Veg. Density	MODERATE
Photo Bearing	N 45° E
Distance	400'

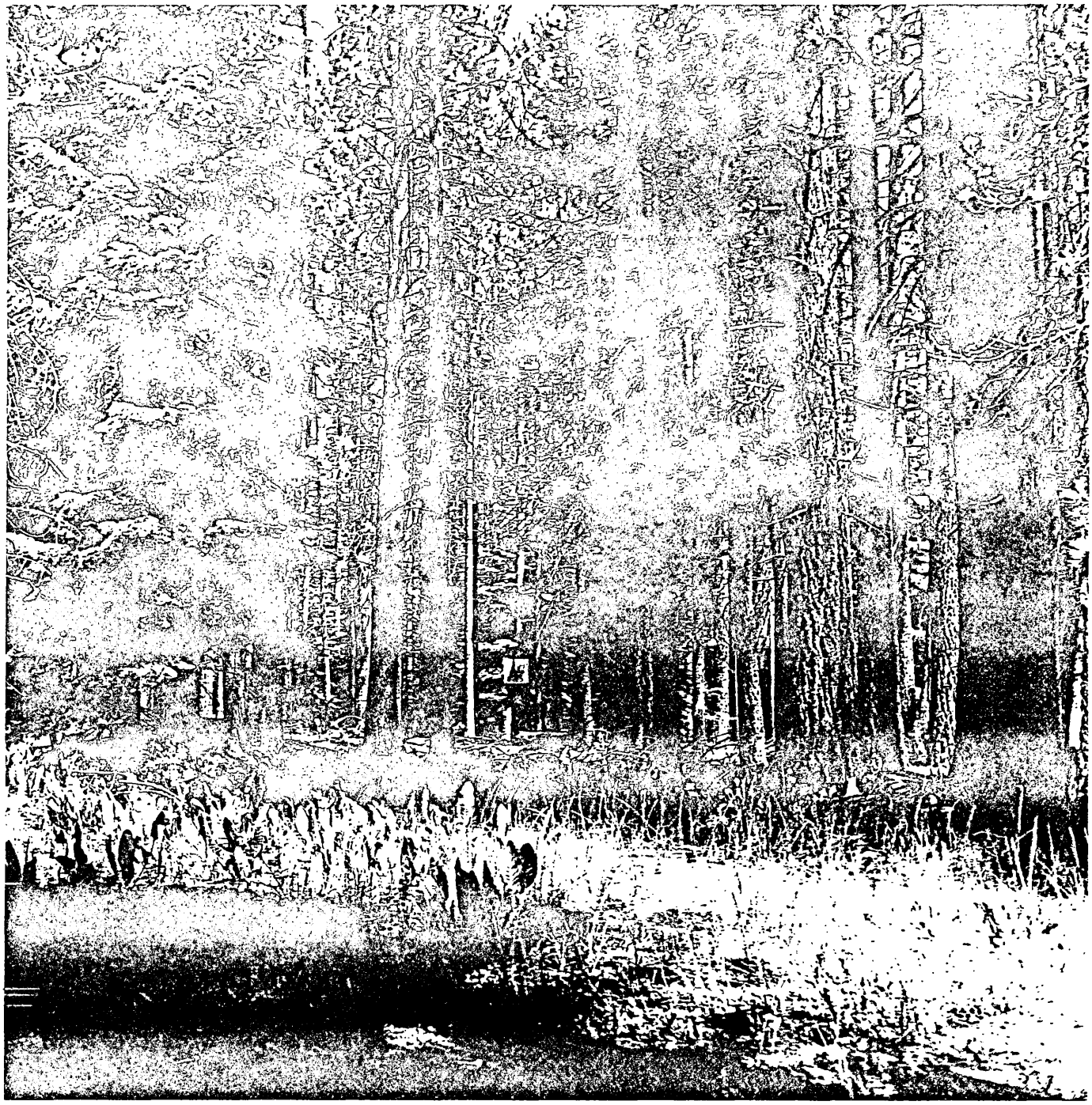


Figure 17
Photo Point 41
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	PINE
Veg. Density	DENSE
Photo Bearing	N 45° W
Distance	225'

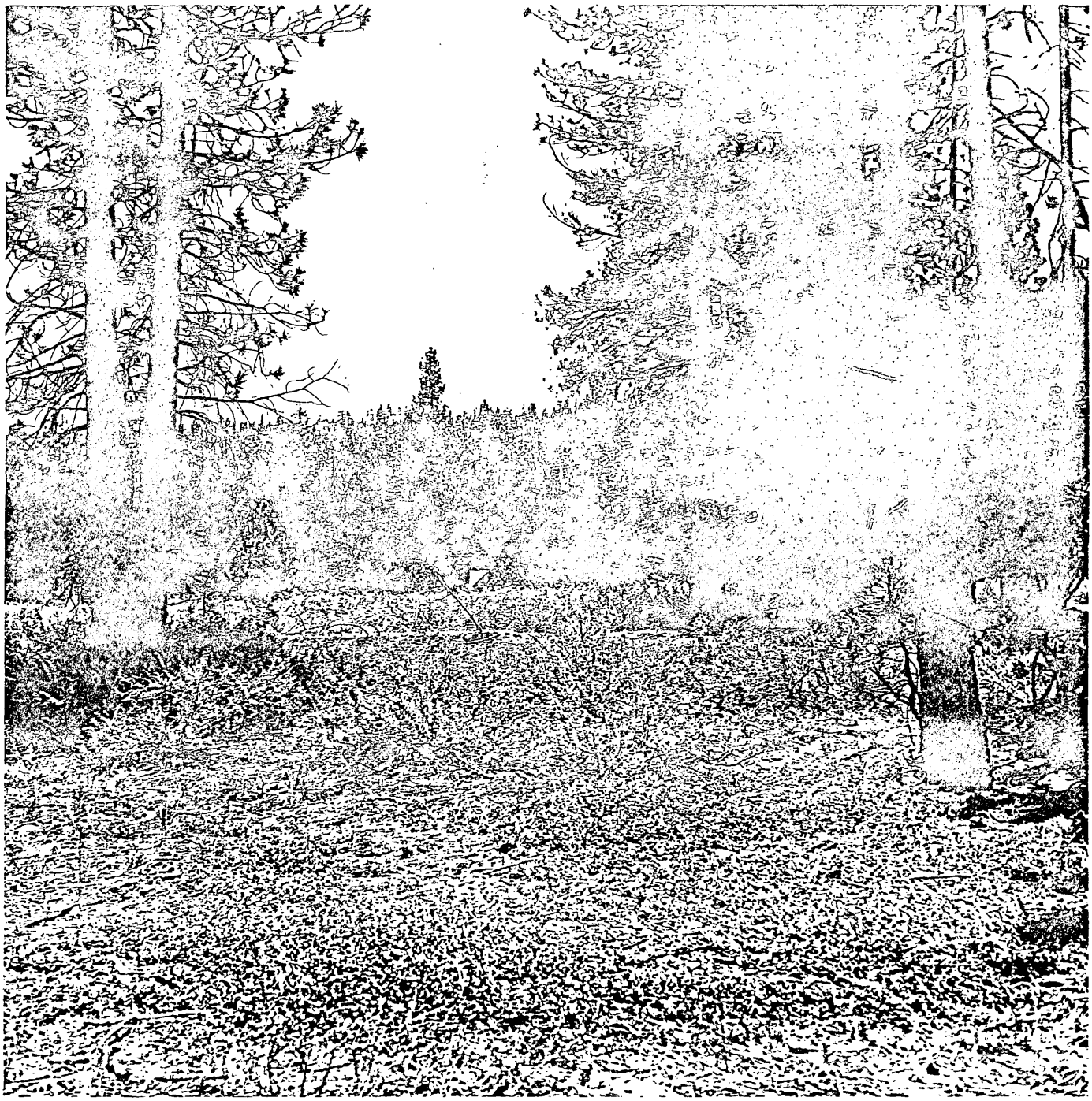


Figure 18
Photo Point 7
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	OPEN
Photo Bearing	S 10° E
Distance	370'

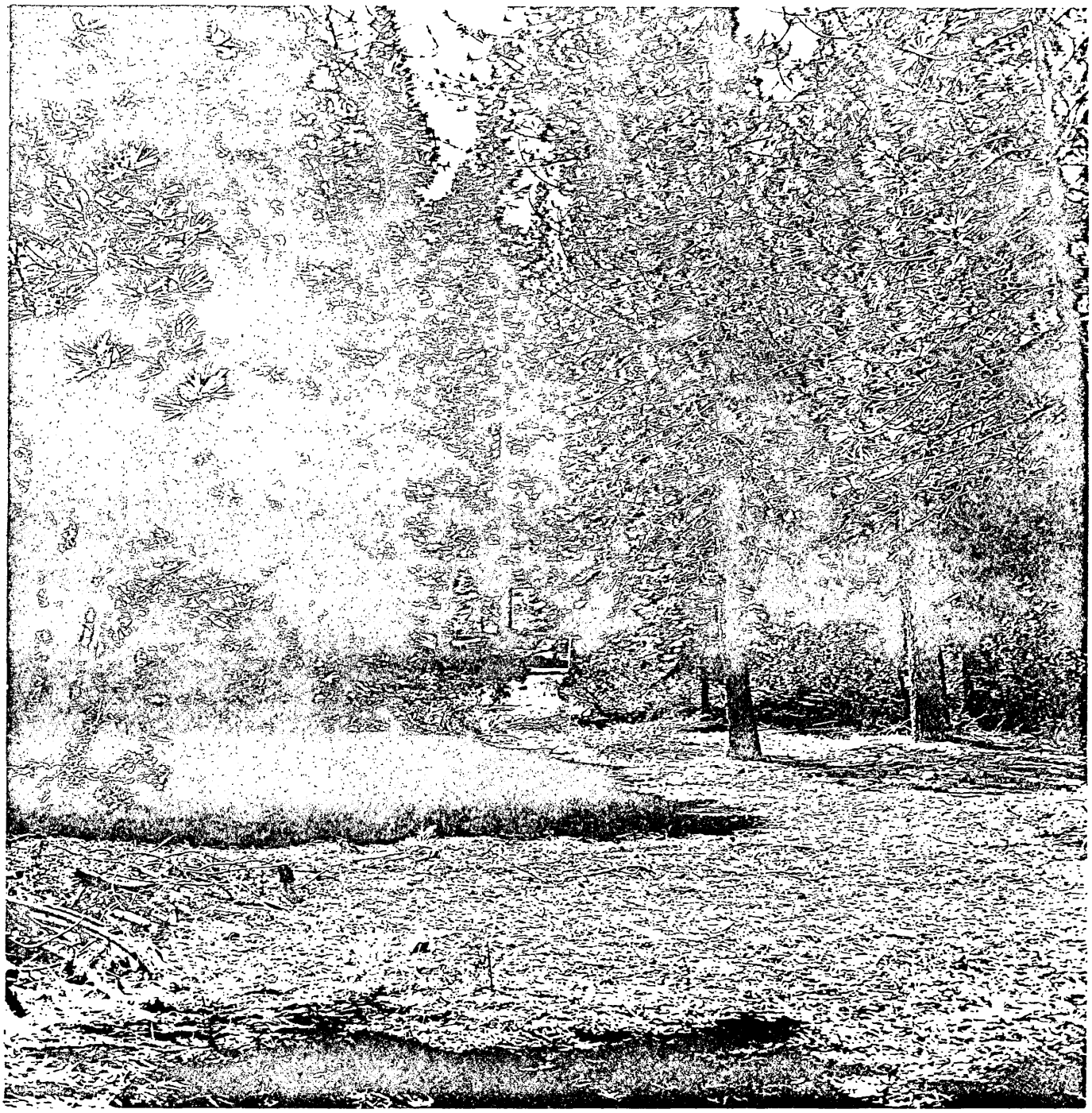


Figure 19
Photo Point 1
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	MODERATE
Photo Bearing	≤ 30° W
Distance	380'

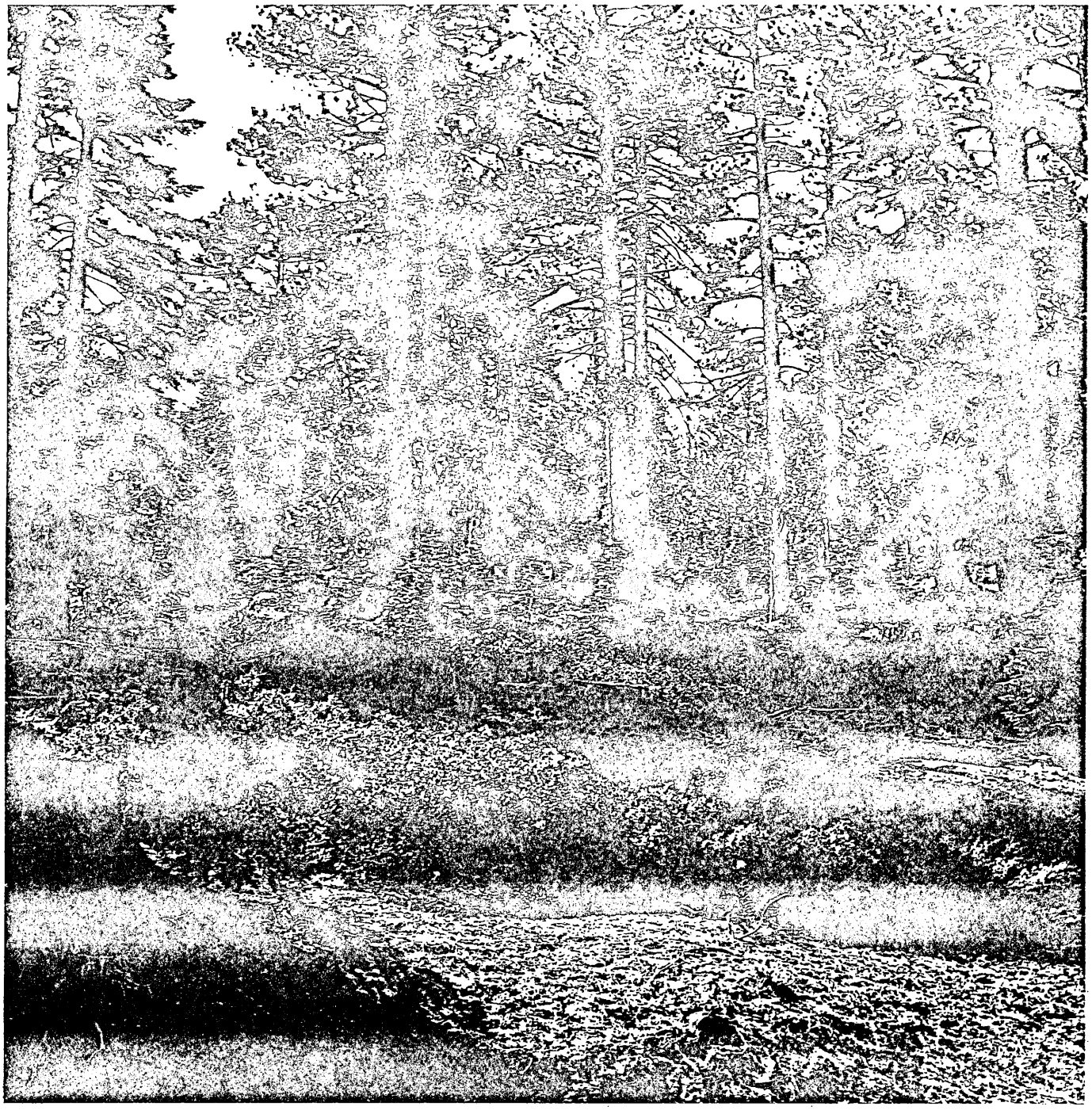


Figure 20
Photo Point 19
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	MODERATE
Photo Bearing	N 40° W
Distance	450'

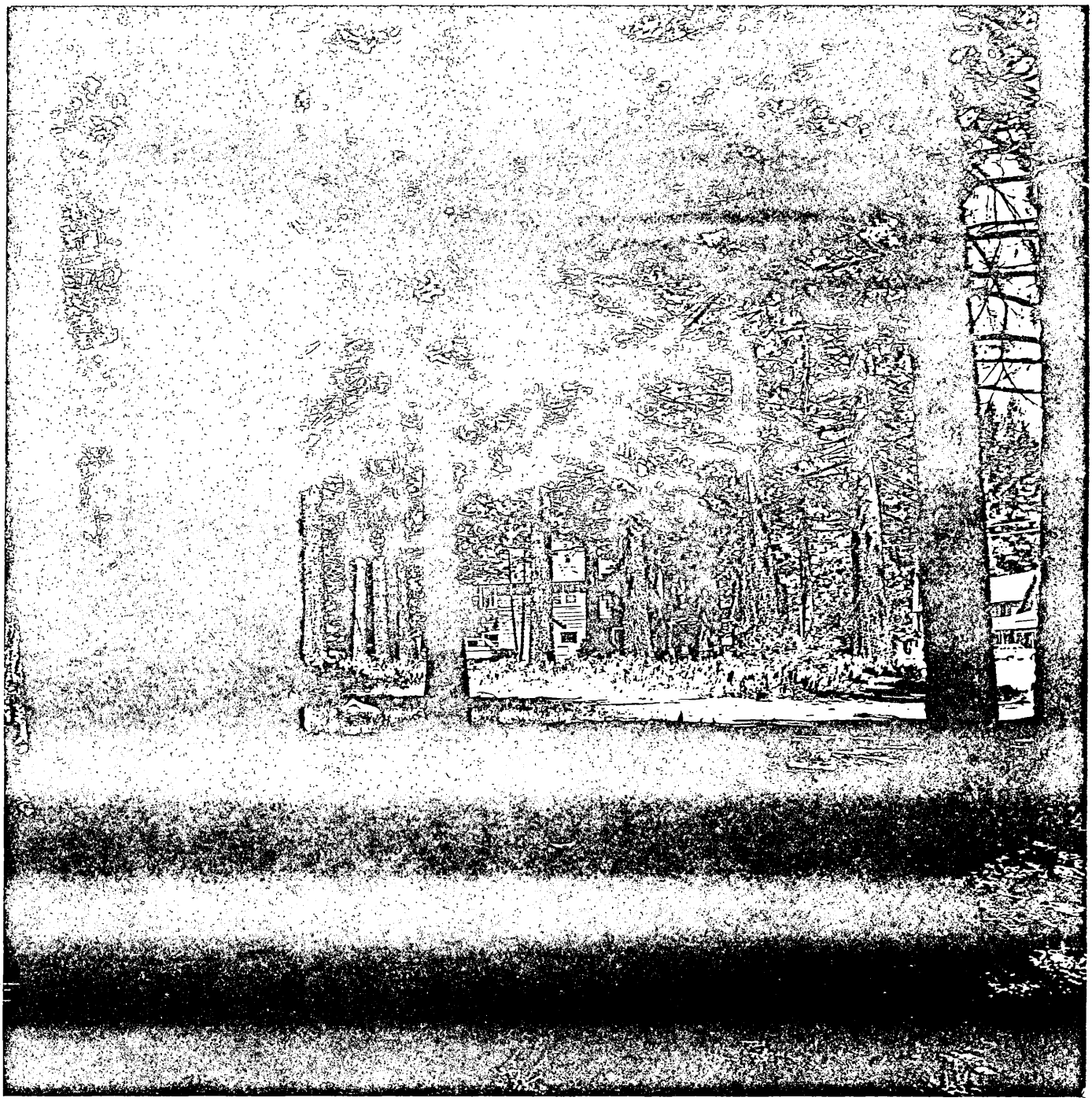


Figure 21
Photo Point 18
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	MODERATE
Photo Bearing	WEST
Distance	300'

Figure 22
Photo Point 21
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg.Type	MIXED CONIFER
Veg. Density	MODERATE
Photo Bearing	N 10°W
Distance	300'

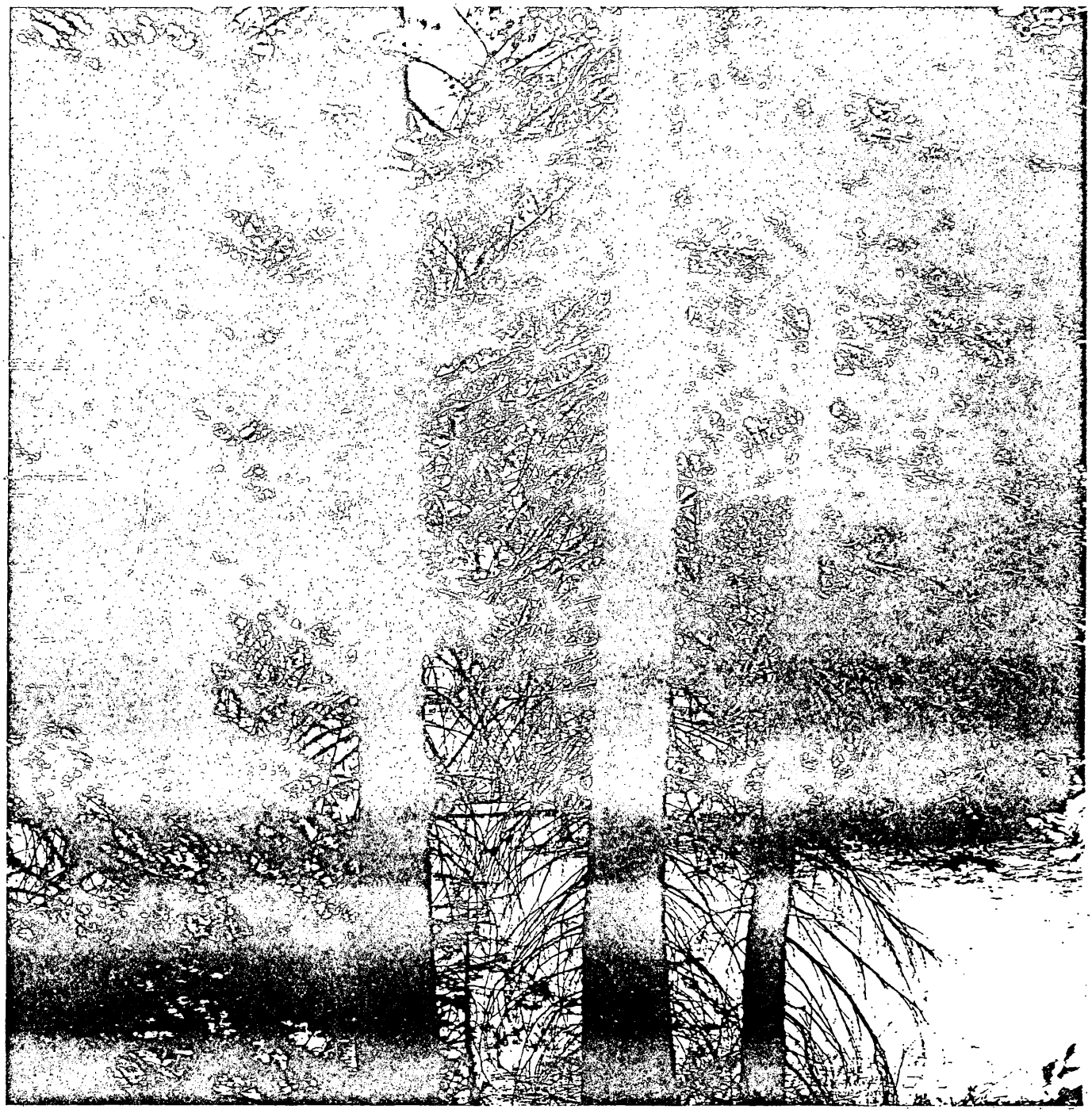


Figure 23
Photo Point 12
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	S 45° E
Distance	250'

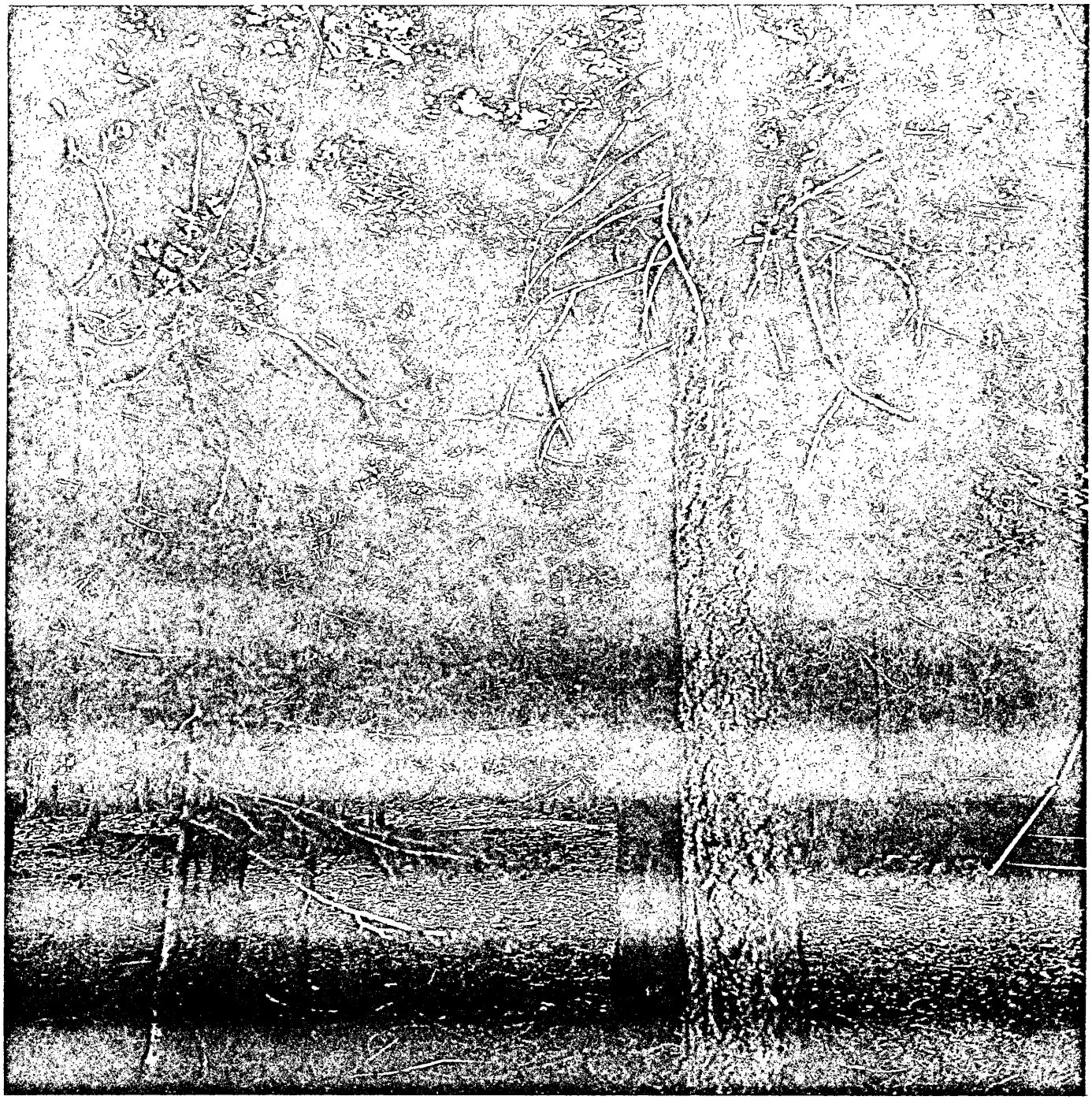


Figure 24
Photo Point 15
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	S 60° W
Distance	150'

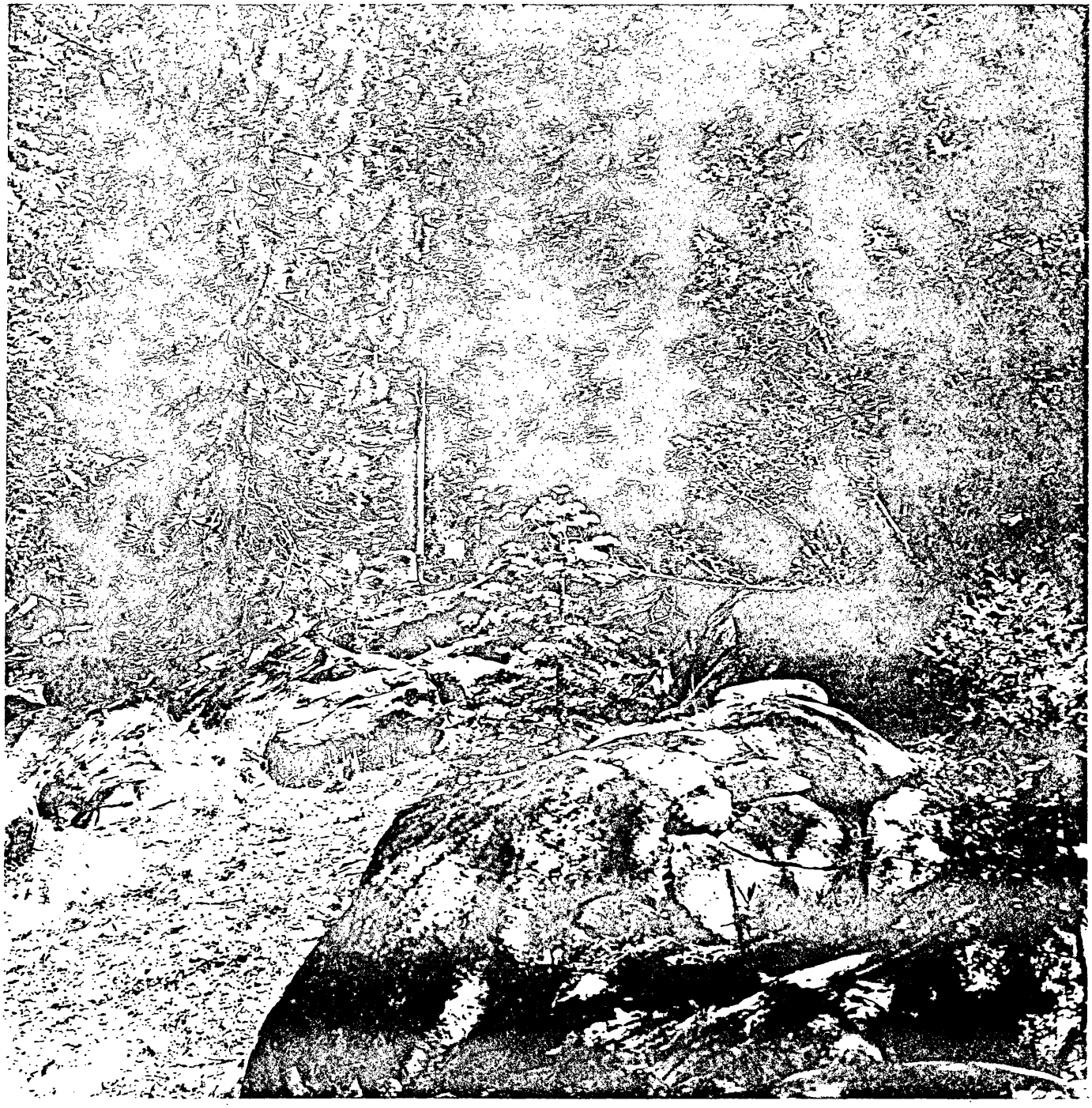


Figure 25
Photo Point 23
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	N.25°E
Distance	250'

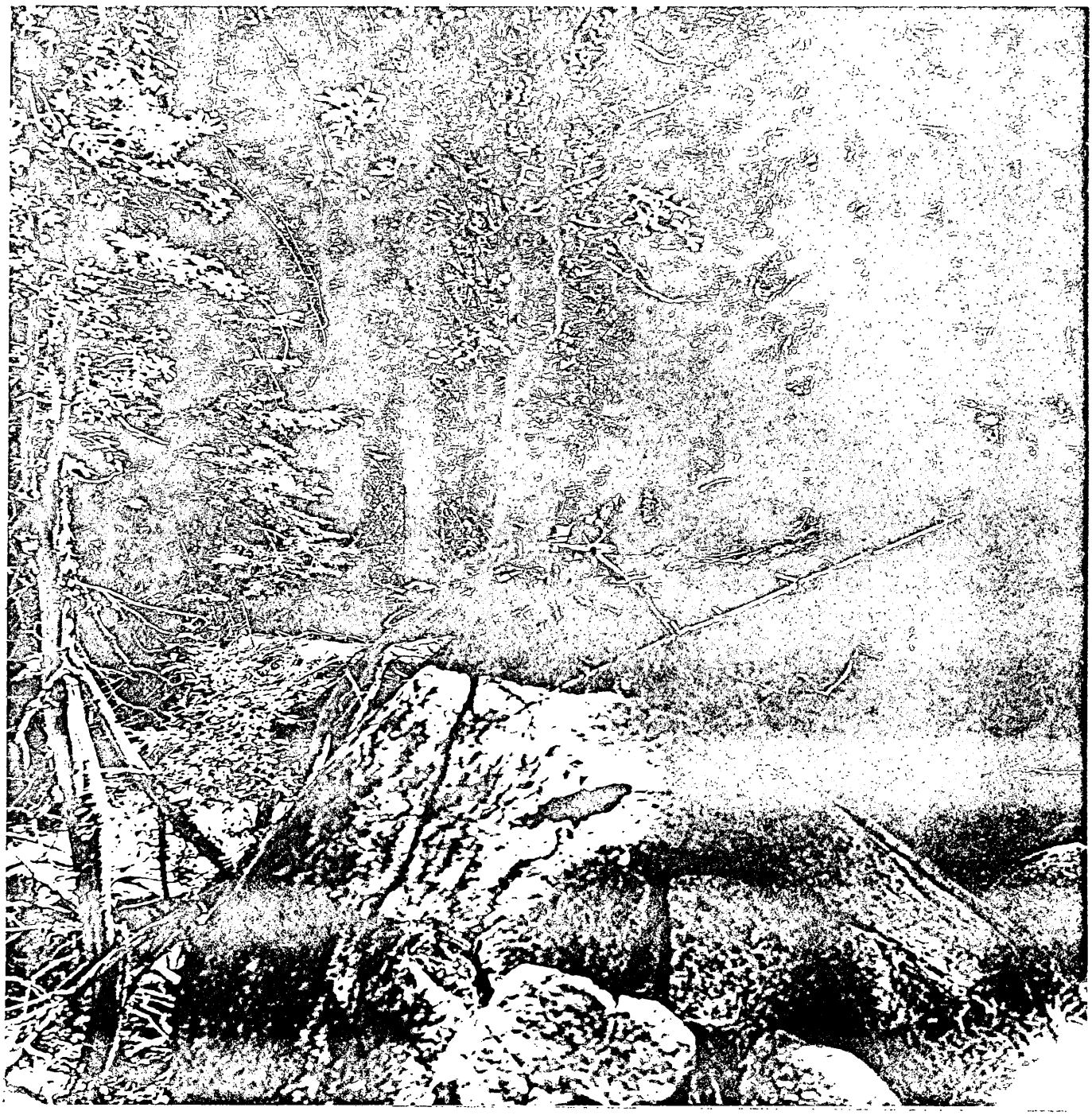


Figure 26
Photo Point 24
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	S 20° E
Distance	170'

Figure 27
Photo Point 29
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	N 25° W
Distance	240'

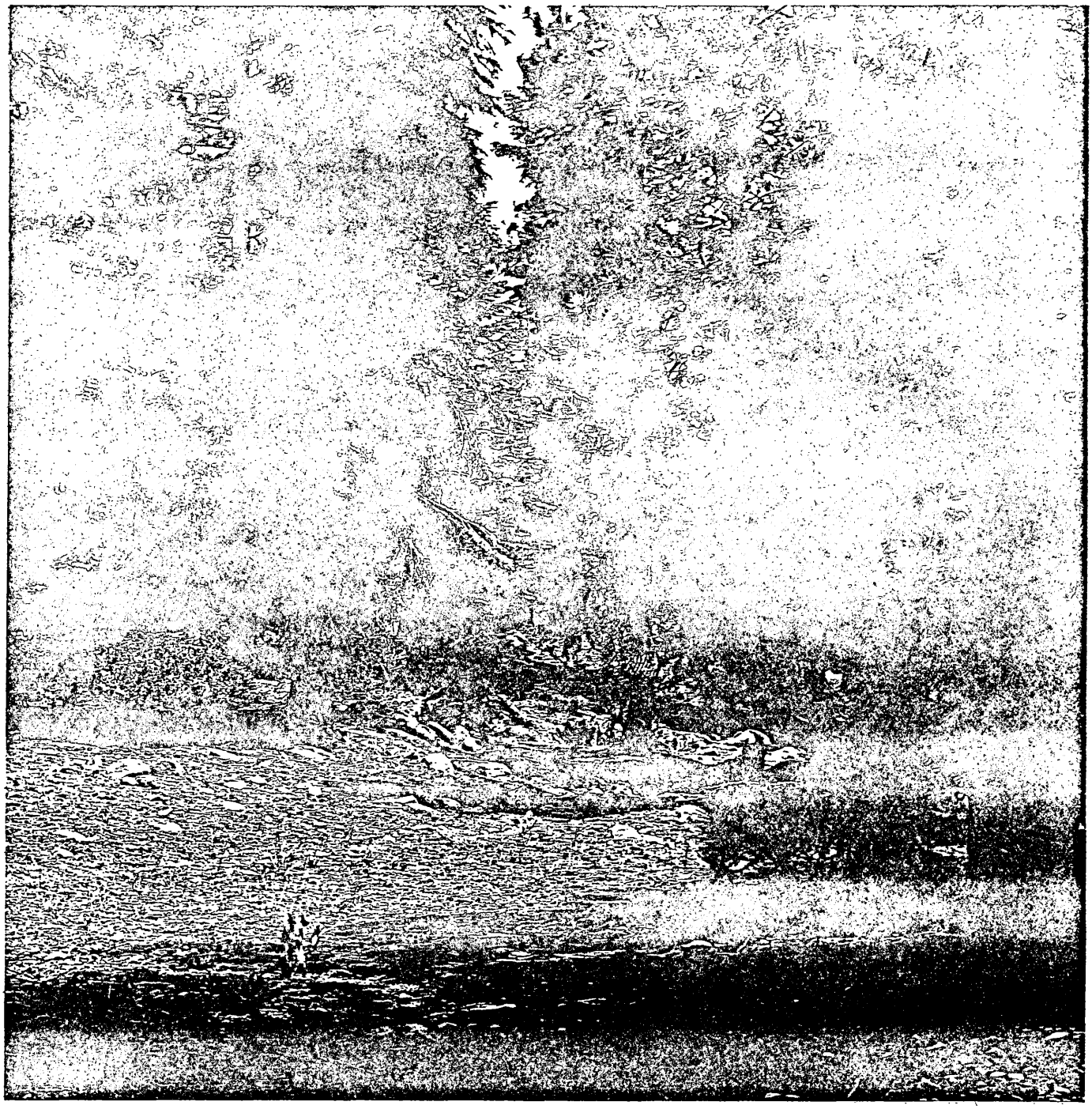


Figure 28
Photo Point 31
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	545°E
Distance	300'

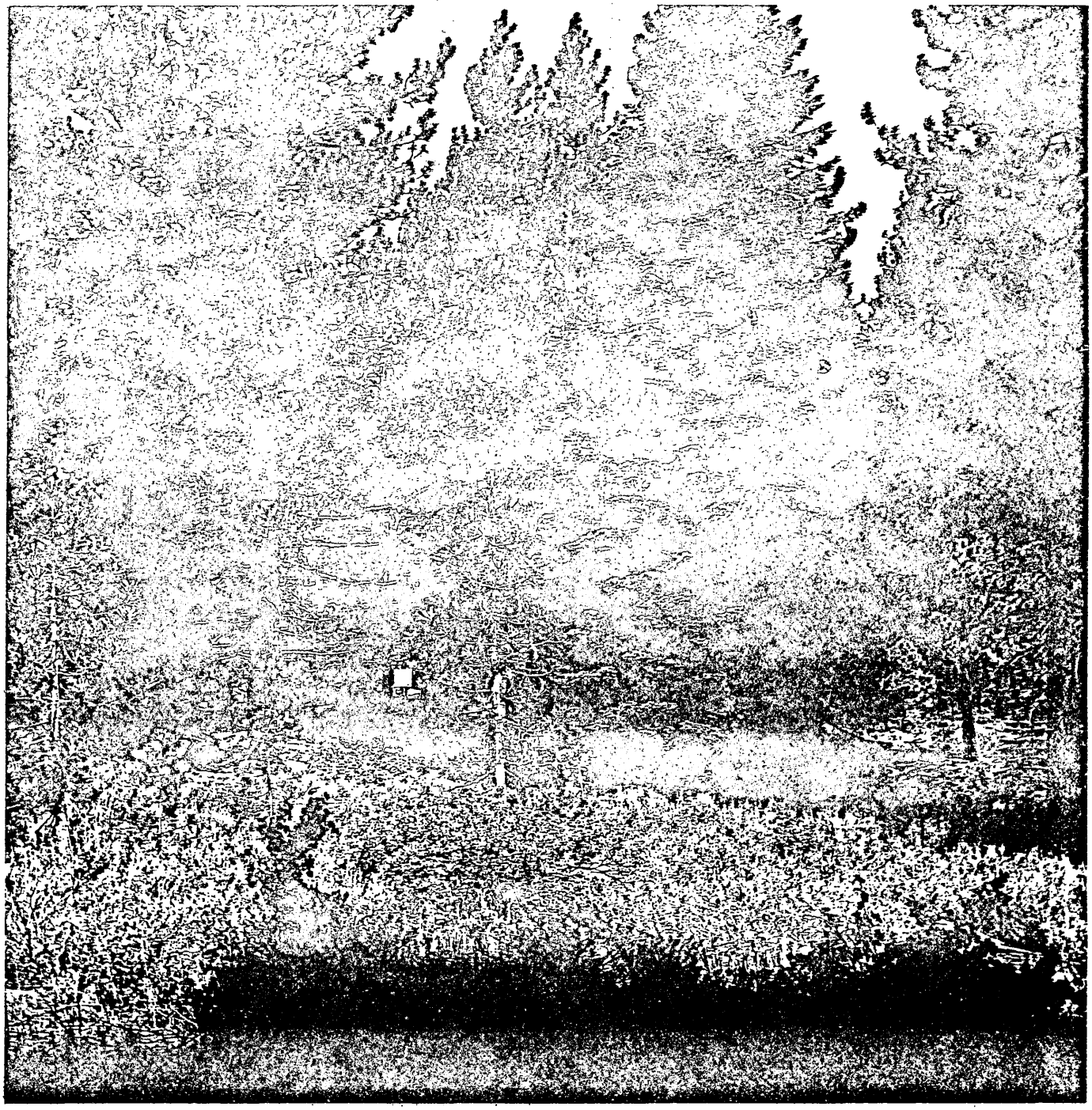


Figure 29
Photo Point 33
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	N 60° W
Distance	350'

Figure 30
Photo Point 39
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	WEST
Distance	150'

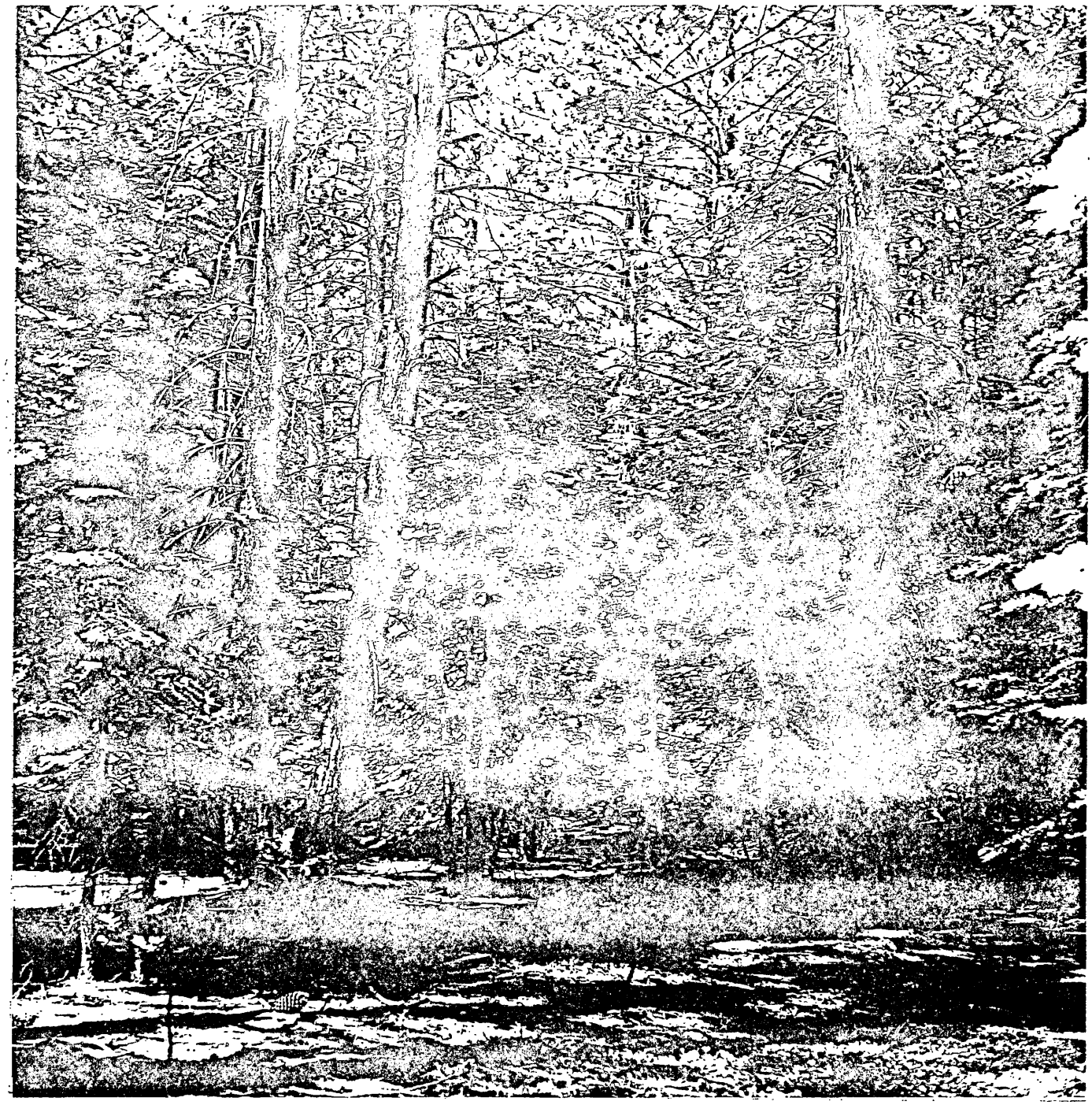


Figure 31
Photo Point 40
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	S 45° W
Distance	180'

Figure 32
Photo Point 43
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	MIXED CONIFER
Veg. Density	DENSE
Photo Bearing	N 30° E
Distance	230'

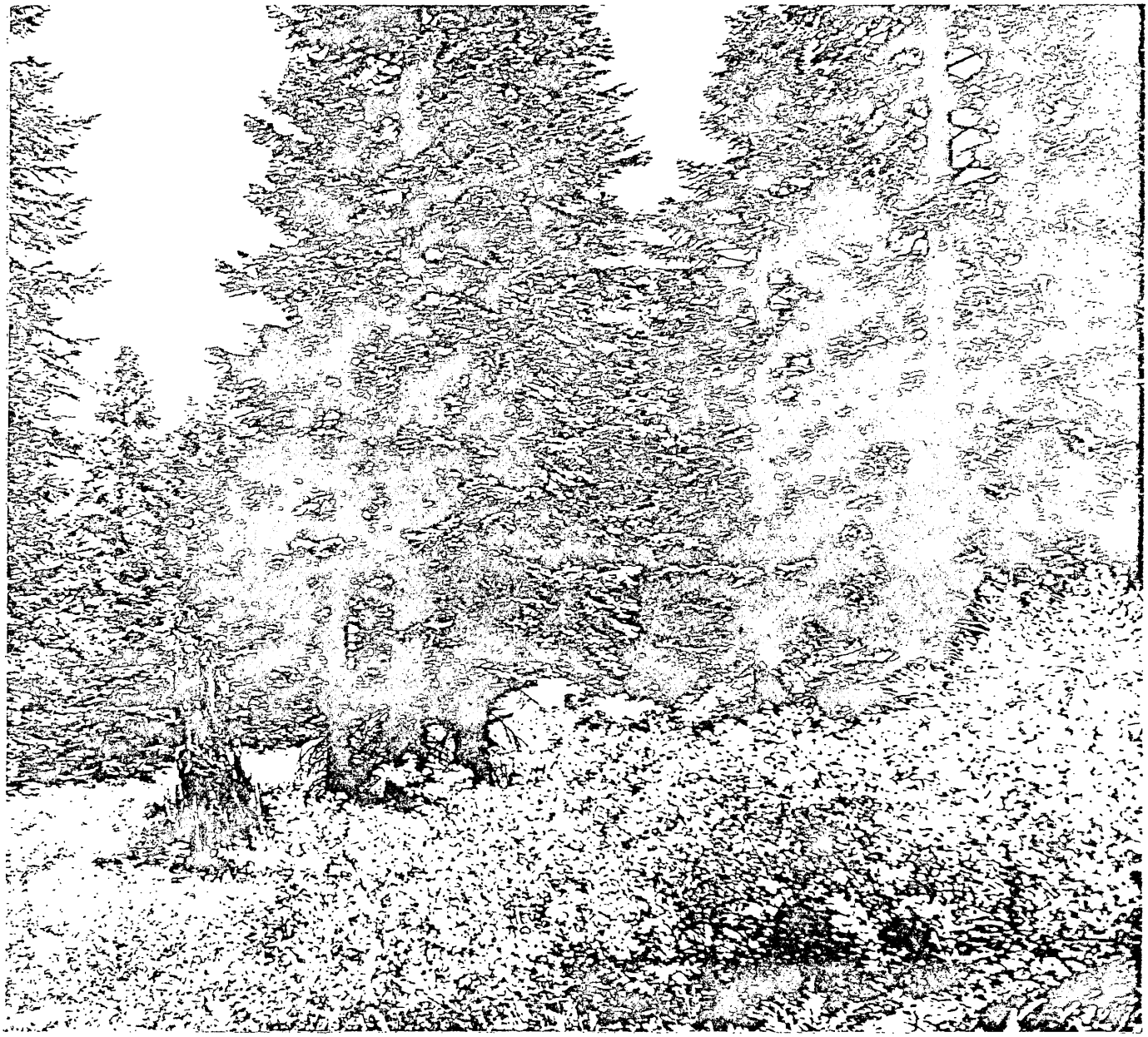


Figure 33
Photo Point 35
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg.Type	FIR
Veg.Density	MODERATE
Photo Bearing	N 60° W
Distance	250'

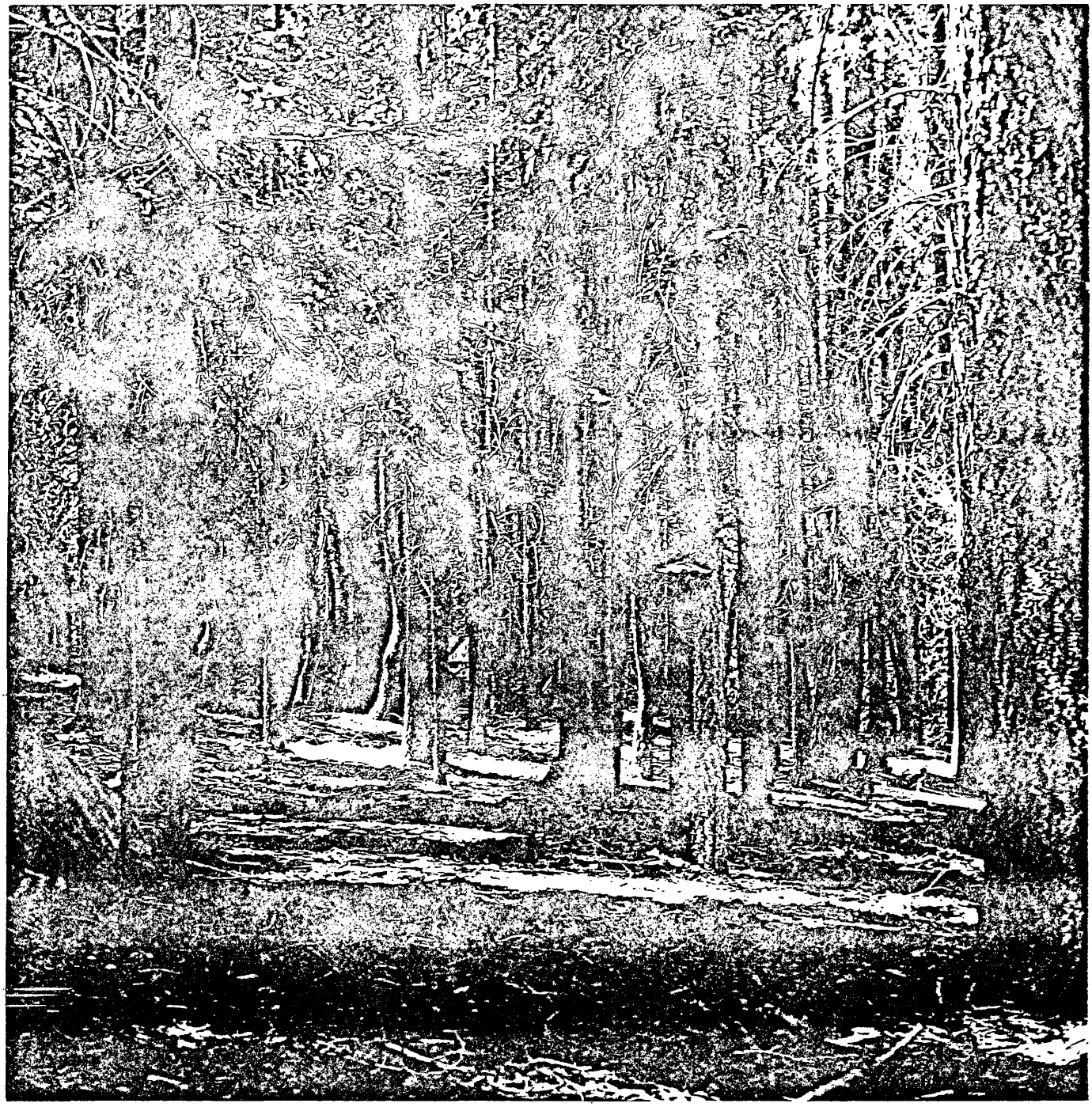


Figure 34
Photo Point 2
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	FIR
Veg. Density	DENSE
Photo Bearing	N 75° W
Distance	230'

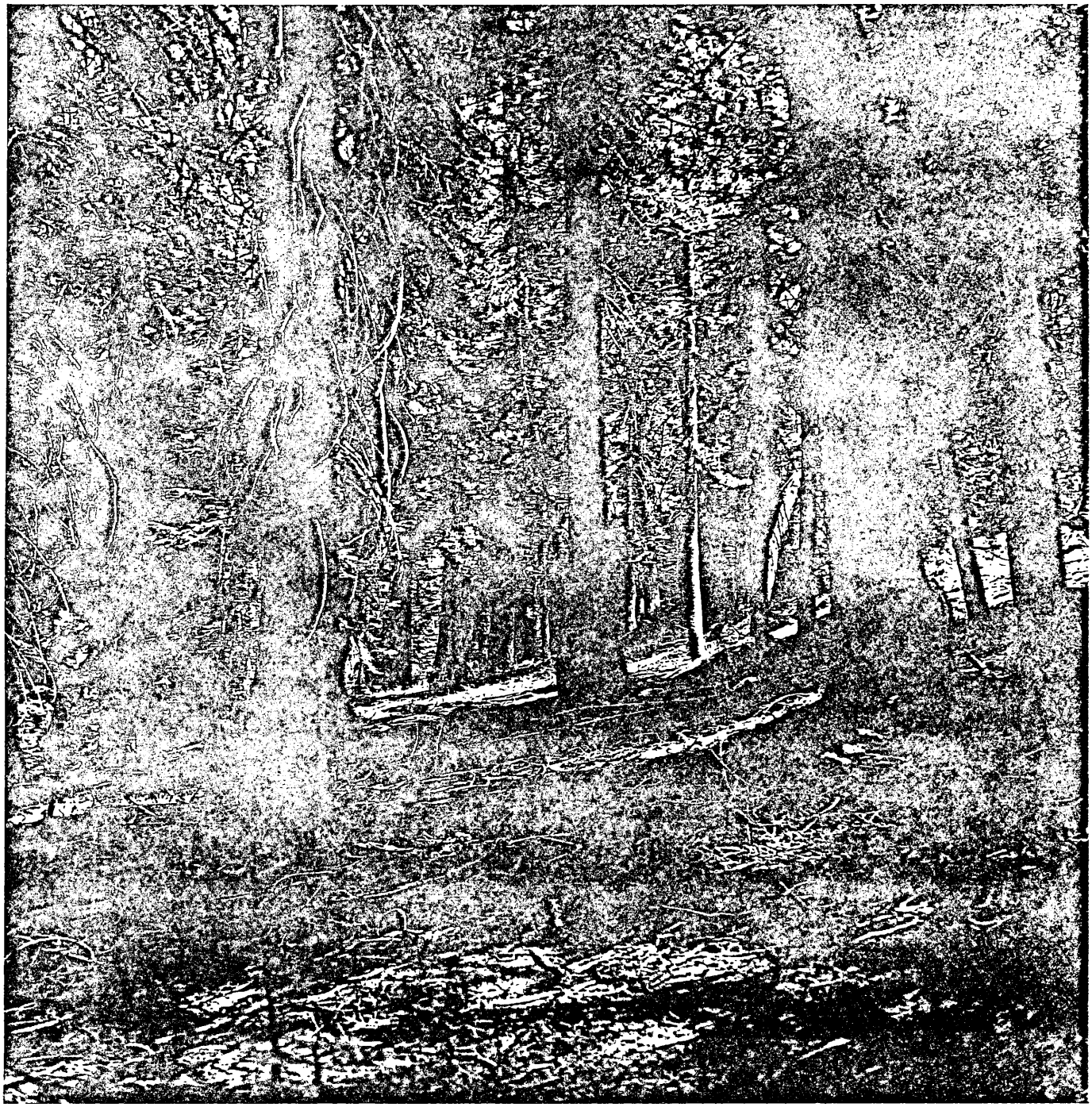


Figure 35
Photo Point 26
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	FIR
Veg. Density	DENSE
Photo Bearing	S 60° E
Distance	250'

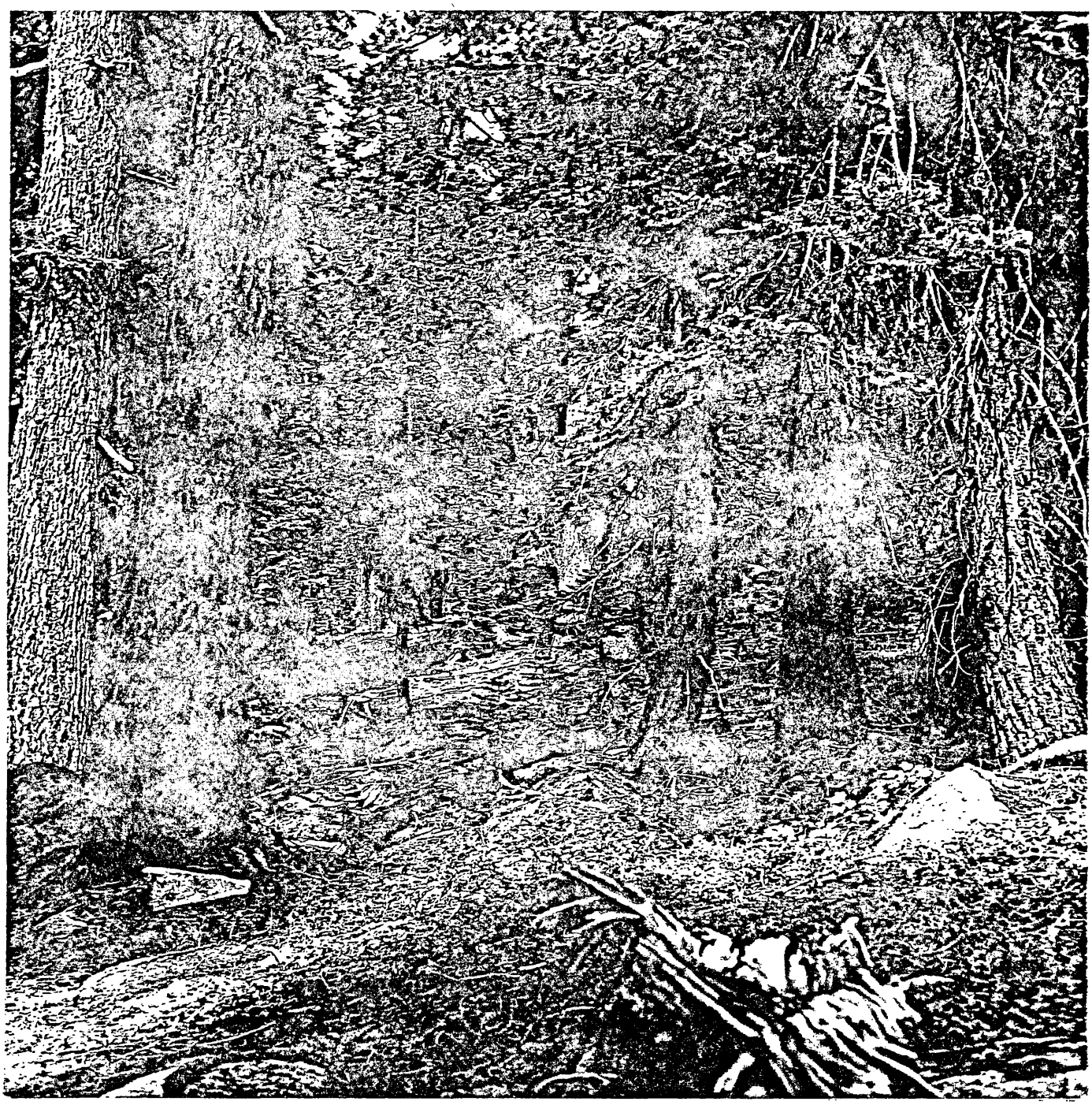


Figure 36
Photo Point 27
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg.Type	FIR
Veg.Density	DENSE
Photo Bearing	N 60° E
Distance	250'

Figure 37
Photo Point 28
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	FIR
Veg. Density	DENSE
Photo Bearing	545°W
Distance	120'

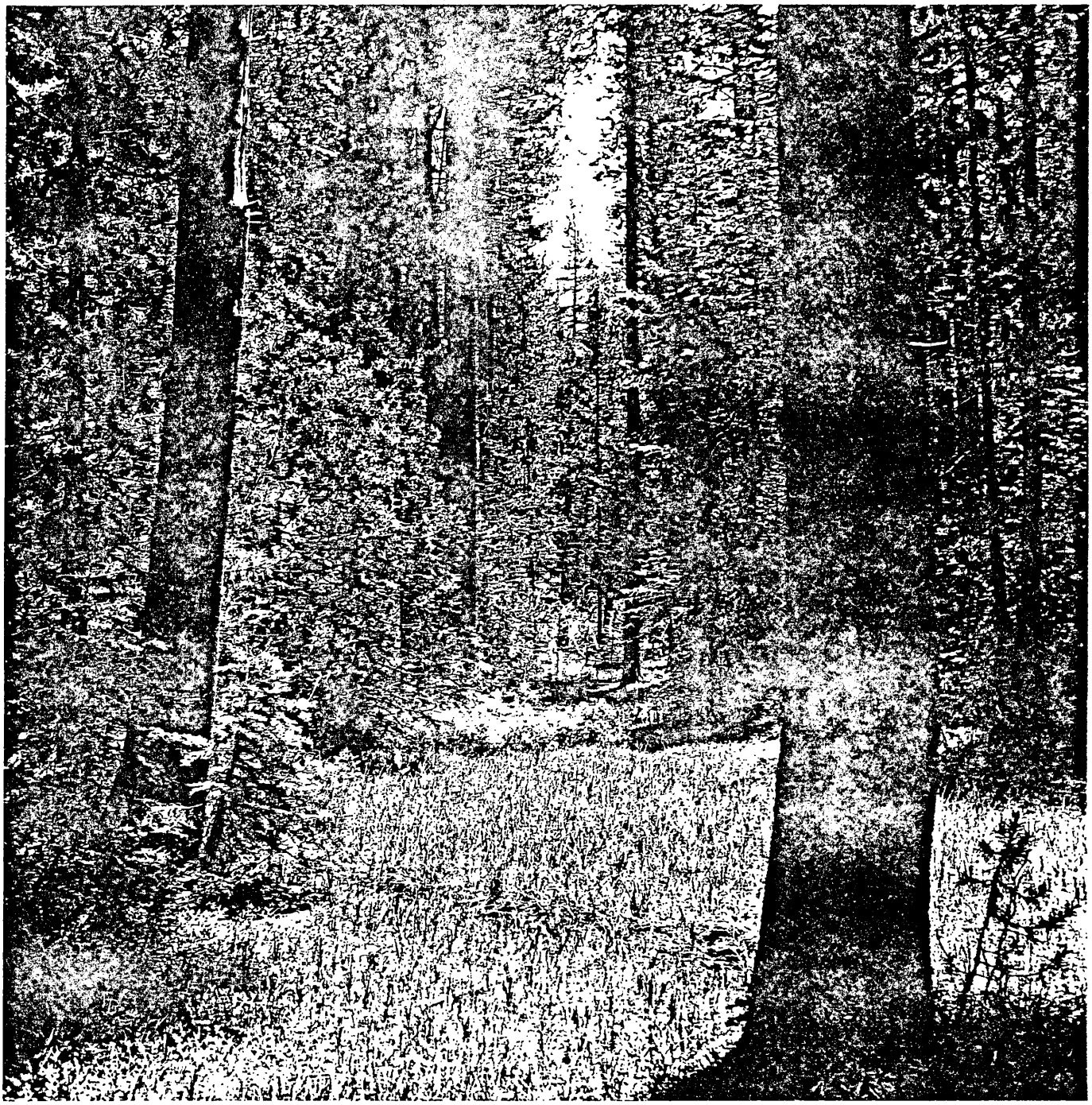


Figure 38
Photo Point 13
LAKE TAHOE VISUAL ABSORPTION STUDY

Veg. Type	LODGEPOLE PINE
Veg. Density	MODERATE
Photo Bearing	S 70° E
Distance	300'

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